THE

JOURNAL

OF

GAS LIGHTING,

WATER SUPPLY,

ETC.

VOL. CVII.

JULY TO SEPTEMBER, 1909.

LONDON:

WALTER KING,

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1909.

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THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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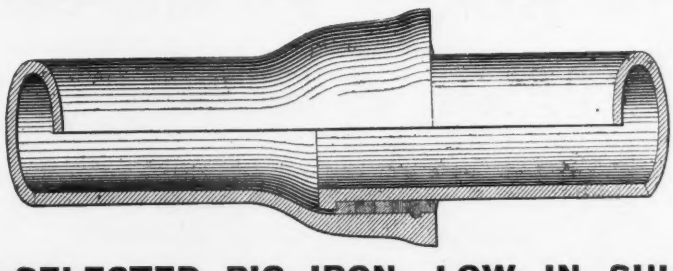

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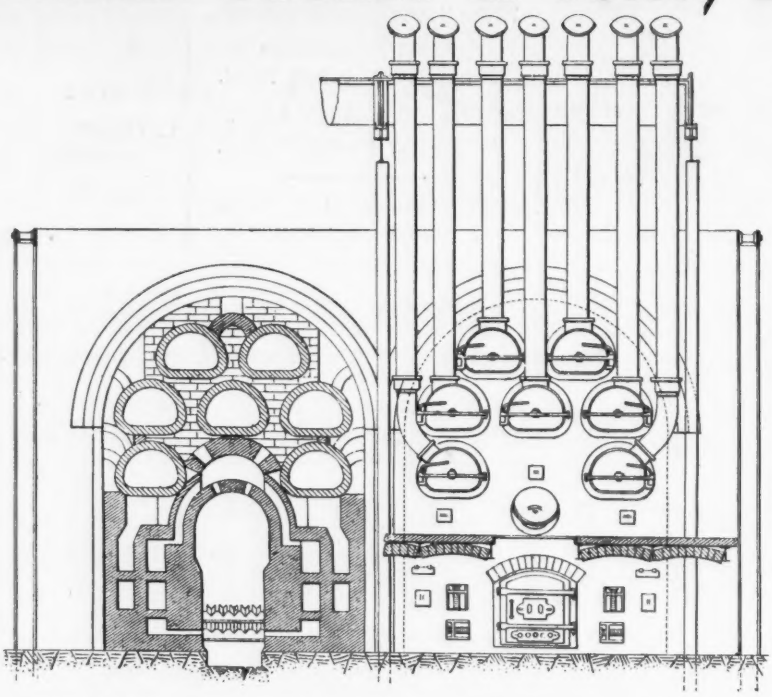

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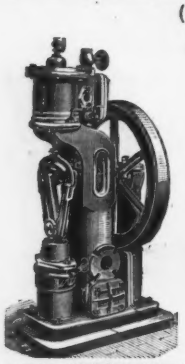

Fig. 705. "SINGLE RAM" STEAM-PUMP.

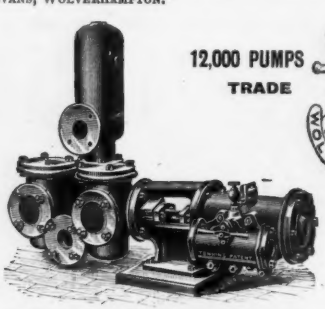

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

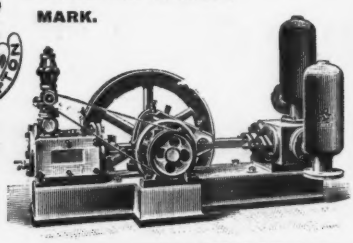

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

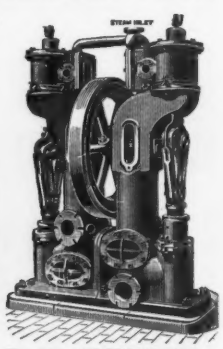

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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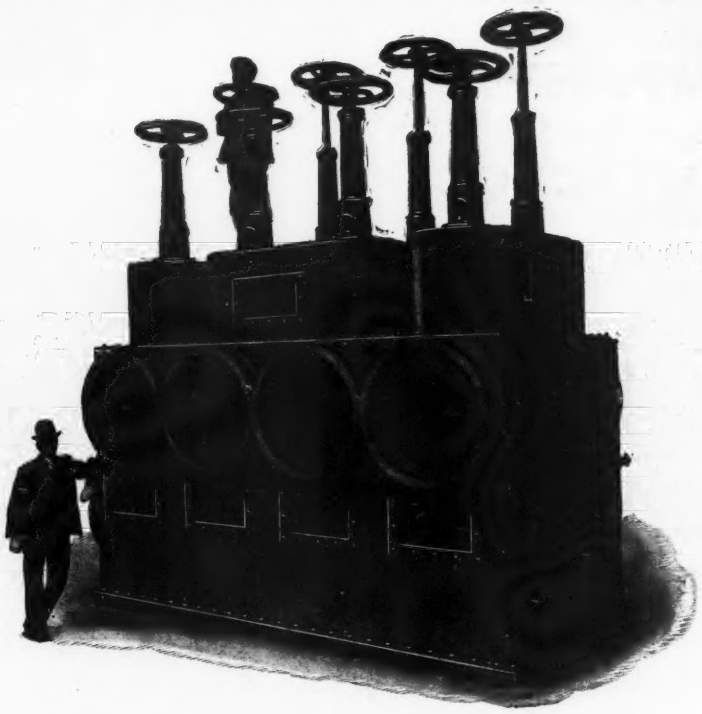

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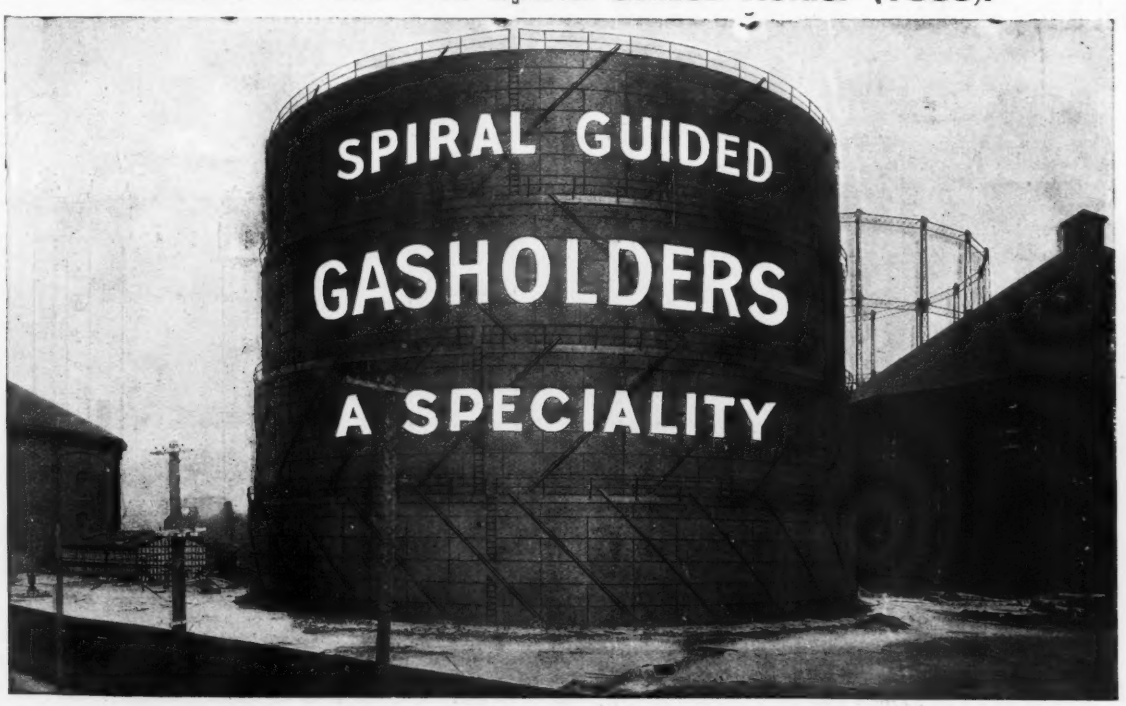

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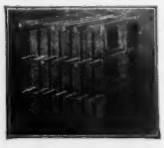

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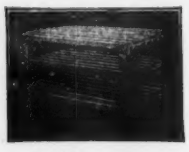

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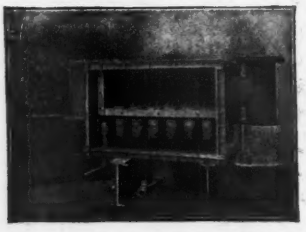

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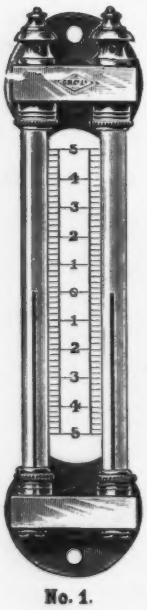

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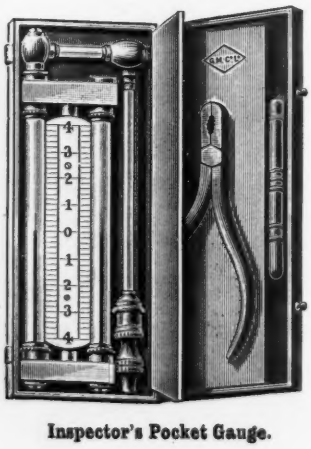

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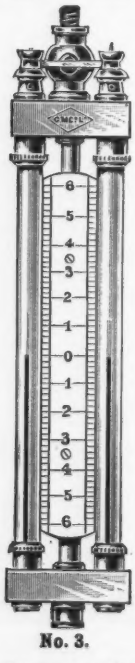

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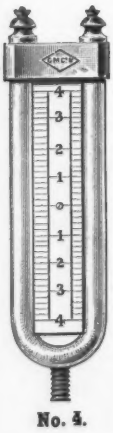

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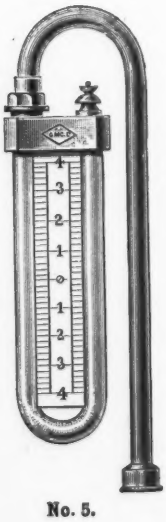

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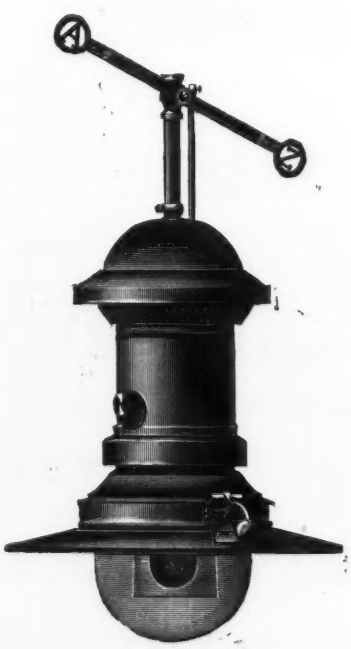

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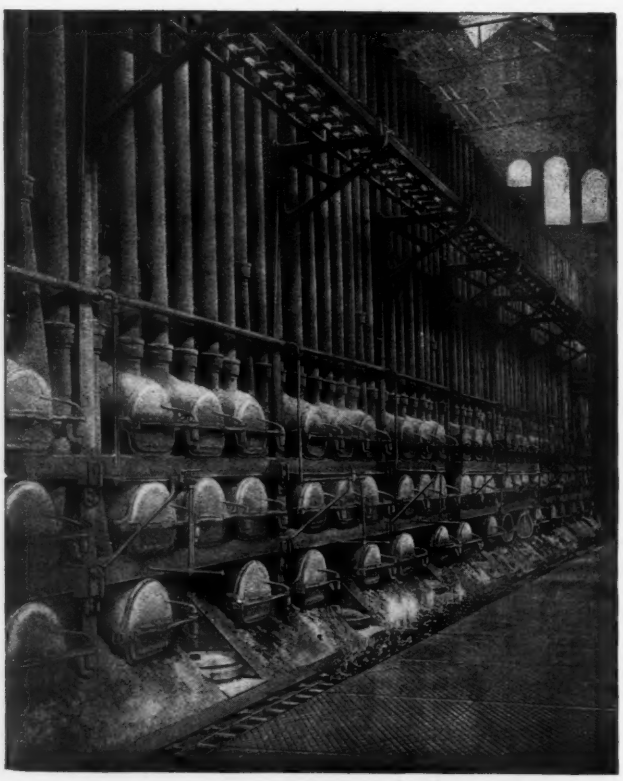

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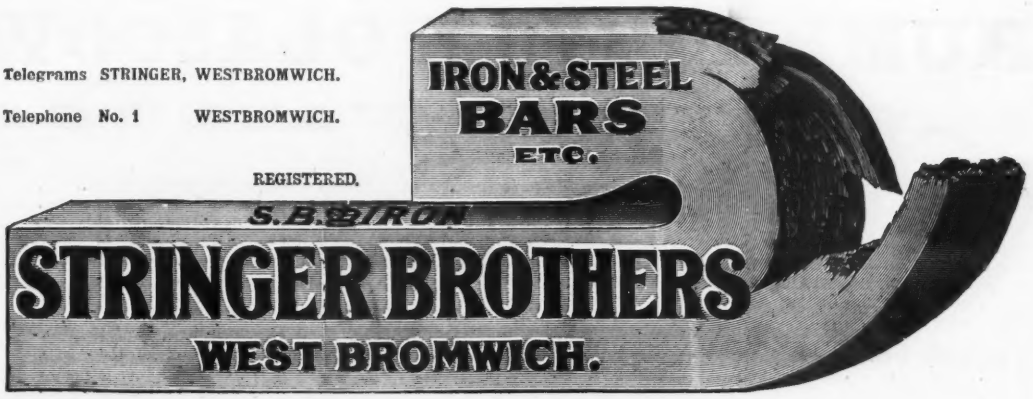

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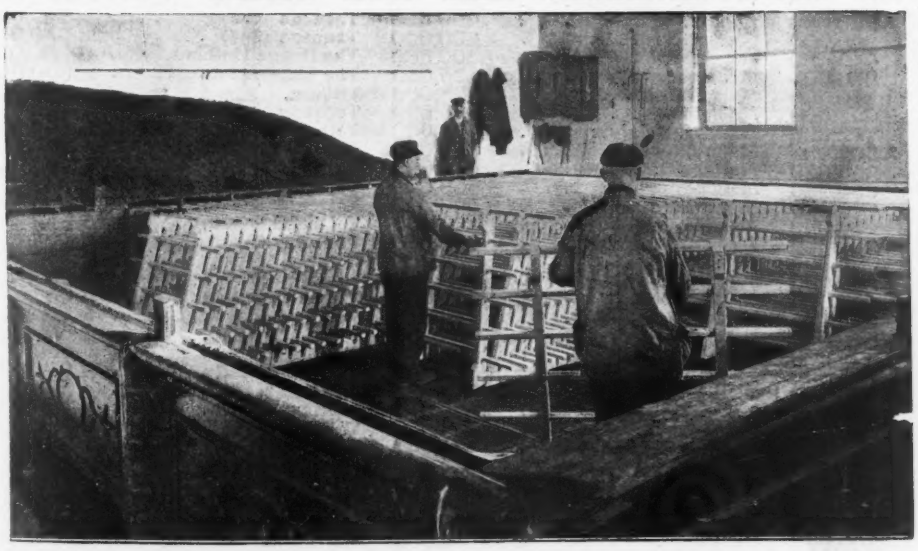

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Bremen, Germany	550,000	Holyoke, Mass.	600,000	Schwelm, Westphalia	100,000
Bremen (2nd)	950,000	Hong Kong	450,000	Shanghai	225,000
Bremen (3rd)	850,000	Hull	1,500,000	Shanghai (2nd)	225,000
Brentford	1,200,000	Ilford	650,000	Shanghai (3rd)	1,600,000
Brentford (2nd)	850,000	Innsbruck, Austria	200,000	Southampton	800,000
Bridgwater	200,000	Ipswich	750,000	Southampton (2nd)	500,000
Bridlington	150,000	Kampen, Holland	350,000	Southampton (3rd)	600,000
Bridlington (2nd)	200,000	Kiel, Sleswig	1,000,000	Southgate	400,000
Brieg, Silesia	100,000	Kiel (2nd)	880,000	Southport	750,000
Brighton	1,750,000	L. & N.W. Rly., Crewe	700,000	Southport (2nd)	900,000
Brighton (2nd)	1,850,000	Lausanne, Switz.	250,000	South Shields	650,000
Bromley	1,500,000	Lawrence, Mass.	400,000	Stafford	500,000
Bruges, Belgium	200,000	Lea Bridge	350,000	Staines	600,000
Brussels—Anderlecht	350,000	Lea Bridge (2nd)	350,000	Stettin, Germany	880,000
Brussels—Anderlecht (2nd)	350,000	Lea Bridge (3rd)	400,000	Stockholm	1,500,000
Brussels—Forest	1,000,000	Lea Bridge (4th)	1,000,000	Stockholm (2nd)	1,750,000
Brussels—Koekelberg	1,000,000	Leeuwarden, Holland	400,000	Stockport	600,000
Brussels—St. Gilles	1,000,000	Leiden, Holland	500,000	Stockport (2nd)	600,000
Brussels—St. Josse	1,000,000	Leiden (2nd)	575,000	Stockport (3rd)	400,000
Brussels—St. Josse (2nd)	600,000	Leigh, Lancs.	350,000	Stockton-on-Tees	500,000
Brussels—Ville	750,000	Lemberg, Galicia	260,000	Swansea	750,000
Brussels—Ville (2nd)	750,000	Lemberg (2nd)	500,000	Swansea (2nd)	1,000,000
Brussels—Ville (3rd)	1,500,000	Liége, Belgium	1,000,000	Swansea (3rd)	450,000
Brussels—Ville (4th)	350,000	Liége (2nd)	750,000	Swindon	300,000
Bucarest, Roumania	1,100,000	Lincoln	500,000	Sydney—Harbour	500,000
Budapest, Hungary	50,000	Liverpool	3,500,000	Sydney—Harbour (2nd)	500,000
Budapest (2nd)	1,750,000	Liverpool (2nd)	4,500,000	Sydney—Mortlake	500,000
Carlisle	600,000	Longton	600,000	Sydney—Mortlake (2nd)	500,000
Carlsruhe, Germany	500,000	Louvain, Belgium	800,000	Syracuse, N.Y.	850,000
Chigwell	350,000	Lübeck, Germany	400,000	Taunton	225,000
Chorley	300,000	Maastricht, Holland	200,000	Taunton (2nd)	350,000
Commercial, London	850,000	Magdeburg, Germany	1,400,000	The Hague Holland	1,000,000
Commercial (2nd)	850,000	Maidenhead	225,000	The Hague (2nd)	500,000
Commercial (3rd)	1,250,000	Maidenhead (2nd)	225,000	Tilburg, Holland	400,000
Commercial (4th)	2,000,000	Maidstone	500,000	Torquay	350,000
Copenhagen	700,000	Malines, Belgium	500,000	Tottenham	750,000
Copenhagen (2nd)	2,500,000	Malmö, Sweden	350,000	Tottenham (2nd)	750,000
Courtrai, Belgium	250,000	Malta	400,000	Tottenham (3rd)	350,000
Coventry	600,000	Manchester	3,500,000	Tottenham (4th)	1,000,000
Coventry (2nd)	600,000	Manchester (2nd)	3,500,000	Tottenham (5th)	1,000,000
Cracow, Galicia	200,000	Marlborough	100,000	Tottenham (6th)	1,250,000
Cracow (2nd)	200,000	Mayence, Germany	700,000	Tunbridge Wells	1,000,000
Crefeld, Germany	500,000	McKeesport, Pa.	500,000	Utrecht, Holland	1,000,000
Croydon	1,250,000	Merthyr Tydfil	300,000	Utrecht (2nd)	1,000,000
Croydon (2nd)	625,000	Middlesbrough	1,250,000	Verviers, Belgium	1,000,000
Croydon (3rd)	625,000	Namur, Belgium	175,000	Vienna	3,500,000
Croydon (4th)	550,000	Nelson	400,000	Vienna (2nd)	2,500,000
Debreczin, Hungary	100,000	Newburgh, N.Y.	600,000	Waltham	400,000
Deventer, Holland	150,000	New York	5,200,000	Wandsworth & Putney	1,800,000
Deventer (2nd)	200,000	Nictheroy, Brazil	250,000	Watford	300,000
Dorking	150,000	North Middlesex	150,000	Watford (2nd)	350,000
Dublin	2,000,000	North Middlesex (2nd)	200,000	Wellington, N.Z.	350,000
Dublin (2nd)	2,000,000	North Middlesex (3rd)	75,000	West Ham	1,500,000
Dublin (3rd)	650,000	Norwich	1,000,000	West Ham (2nd)	800,000
Dundee	1,500,000	Norwich (2nd)	300,000	Weston-super-Mare	350,000
Dunedin, N.Z.	150,000	Norwich (3rd)	500,000	Weston (2nd)	350,000
Dunedin, N.Z. (2nd)	275,000	Nottingham	1,000,000	Wexford, Ireland	100,000
Durham	200,000	Nuneaton	125,000	Wiesbaden, Germany	850,000
Düsseldorf, Germany	1,000,000	Oberhausen, Germany	175,000	Winchester	225,000
Eastbourne	1,250,000	Oldenburg, Germany	200,000	Winchester (2nd)	125,000
Edinburgh	2,000,000	Ostend, Belgium	100,000	Wolverhampton	1,500,000
Epsom	225,000	Ostend (2nd)	200,000	Zwolle, Holland	200,000
Falmouth	150,000	Perth, W.A.	125,000	Zwolle (2nd)	200,000
Faversham	200,000	Poole	1,500,000		

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VOL. CVII., No. 2408.—TUESDAY, JULY 6, 1909.

EDITORIAL NOTES—GAS, &c.

The First Dessau Installation in England.

MUCH instructive information as to the working of the Dessau system of vertical retorts has come to us from the Continent; but it will stimulate interest among gas engineers to know that we are now within measurable distance of having a complete installation on a large working scale in operation under the conditions prevailing in this country, and under circumstances eminently favourable for obtaining absolutely independent testimony. If the Dessau system of carbonization on the intermittent principle of charging and discharging is going to expand in favour among gas engineers in this country, it must be, in the first instance, through the Ayres Quay works of the Sunderland Gas Company, and the working of the system there under the direct supervision of the Engineer, Mr. C. Dru Drury. The Dessau system of carbonization is the choice of Mr. Drury, confirmed by the Manager and Secretary (Mr. J. H. Cox)—a choice determined, and a confirmation given, only after carefully investigating and considering the merits of other systems, so far as was possible at the time a decision in the matter had to be arrived at by the Directors. The Ayres Quay Gas-Works have been (or rather the work is within a few weeks of being finished) completely reconstructed, save for the gasholders, from outside boundary wall throughout; and an exceptionally fine opportunity is offered here for obtaining results from the vertical retorts unvitiated by production from, or other causes associated with, extraneous working. The station depending solely upon the vertical retorts for its make of gas, there can be no possibility of error in categorically defining working conditions, and in stating the results realized from those conditions. Labour, fuel account, and make and quality of gas and of secondary products, will all be capable of exact presentment. We think that those who are interested in the introduction of the system into this country are to be congratulated on having secured such a singularly good opening. However that may be, Sunderland possesses more than ordinary interest for the gas engineer at the present time, and will do so in greater degree before many months are over, and as working experiences accrue.

The first bench of six settings of ten vertical retorts on the works will, before very long, be completed; and elsewhere in this issue a description is given of the progressing structure, and as it will shortly finally appear. In good time before the winter's demand sets in, the settings will be under fire, and so working will be well started ere the diagrams begin to exhibit their highest peak-loads for the year. The bench will therefore have the best possible chance of demonstrating its abilities. It consists of no less than sixty retorts; and with the confirming account of good working that is confidently anticipated, a further fifty retorts will be erected. It will be seen from this that the installation will be the first, in such magnitude as at present, of any vertical retort system to be set to work in this country. But, though this is so, the system has had pretty extensive adoption on the Continent. It will be remembered that, in the recent report of Dr. Lessing to the Carbonization Committee of the Institution of Gas Engineers, it was stated that no less than 4022 retorts on the Dessau plan had been erected, or were under erection, on the Continent; but, although this is so, and although there was a special excursion to the Continent last year, comparatively few British gas engineers have had the opportunity of seeing a bench on the system at work. It is not too much to predict that, when the Sunderland installation is in operation, there will be not a few of the colleagues of Mr. Cox and Mr. Drury who will ask permission to make a pilgrimage to Ayres Quay works, for the purpose of observing with their own eyes the bench and its operations, and of inquiring into the working results.

To those who have not experienced the novelty of seeing beds of retorts destitute of mouthpieces fore and aft, but with entrances and exits respectively on top and underneath the bench, the Sunderland settings will prove somewhat striking. And when at work, there is no reason why Continental experience should not be reproduced here in respect of simplicity of operation, small amount of labour required, and consequently low carbonizing costs per ton of coal, as well as the other results and advantages with which "JOURNAL" readers are now fully cognizant. Of course, if the bench is extended to a further five beds, the figures as to costs—from coal reception to coke removal—realized with the six beds should be appreciably reduced. The materials in the plant at Sunderland are all home made, and the labour all home supplied, excepting (in regard to the materials) the lower part of the retorts, which is exposed to the greatest heat, and the fire-bricks for the combustion chambers. These—and these only—were made by the Stettiner Company, who have had long and exclusive experience in the special requirements of these settings, and consequently know precisely what is needed where the temperature is likely to have the most active influence upon the material. This is satisfactory; but the main thing is that the members of the British gas profession will have their interest in the Dessau system sharpened by the approaching advent in working of the first bench in this country at Sunderland.

Reflections on the German Gas Association Meeting.

THE report in last week's "JOURNAL" of the proceedings at this year's meeting of the German Association of Gas and Water Engineers at Frankfort will have indicated that no technical communications of an exceptionally high order of merit or interest were presented. This was not a matter for serious regret, for retrospection is profitable from time to time, and befits the celebration of a jubilee. The Association has now existed for a period of fifty years, and can look back with much satisfaction on a vigorous and fruitful past. Hence the note which dominated the proceedings at the meeting was one of retrospection. The Inaugural Address of Mr. E. Körting, the President, of which a translation, begun last week, is completed in this issue, was retrospective throughout; and so were some of the papers upon water supply. No one, however, who will take the trouble to follow Mr. Körting's review of progress in the gas industry in the course of the past half-century will venture to say that it is not beneficial to pause for a while, and try to learn from the lessons of the past how the problems of the future may most hopefully be approached.

The President's review runs in a spirited and stimulating strain, the full force of which has probably been inadvertently somewhat lessened by the translator. It breathes hope and confidence in the future of the gas industry. Technical advances have done so much in the still recent past towards reducing the cost of manufacturing gas, and increasing the efficiency of the means of utilizing gas for the production of light, heat, and power, that we are disposed to forget, however, that there is a counteracting influence which keeps the price of gas, and therewith the business of gas supply, almost at a standstill. We reduce the labour required on a gas-works, and obtain more gas and more numerous bye-products from a given quantity of coal, and yet there is no sensible reduction in the price at which gas can be sold. In fact, it is only by prompt resort to every fresh improvement in plant, machinery, and processes, and by the exercise of the most careful supervision, that a substantial rise in the selling price of gas has been and can be avoided. The influence which nullifies all the efforts of the managerial

and technical staffs of gas undertakings is the continually increasing cost of labour. It is not only the labour directly engaged in connection with gas manufacture and supply, but also that engaged elsewhere, and in particular in the winning of coal. A decade witnesses a remarkable advance in the cost of the staple raw material of gas manufacture—in twenty years, according to Mr. Körting, the rise in the cost of Silesian coal to the Berlin Gas-Works has been from 17s. to 22s. per ton. This rise is, no doubt, in part due to the oppressive machinations of the German Coal Syndicate; and, in this respect, gas undertakings in this country are perhaps somewhat better off than those in Germany. But, nevertheless, the miners' organizations here and there have, directly and indirectly, imposed conditions on the colliery owners which entail a substantial increase in the wages paid per ton of coal raised; and hence gas-works have to pay more for their raw material than formerly. Then there is the rise in the rate of pay of the men employed by gas undertakings. In so far as those engaged on the gas-works are concerned, labour-saving devices have neutralized the effect of the rise. There is, however, a large and ever-increasing staff engaged outside the gas-works, whose wages are continually in the ascendant. The prepayment gas-meter, mantle maintenance, high-pressure lighting, and most modern developments of the business of gas supply, entail the employment of more and more hands outside the gas-works; and the wages account thereby becomes very heavy. In a few branches of this outside work, labour-saving schemes are becoming practicable—to wit, the impending displacement of lamp-lighters by automatic igniting and extinguishing appliances. Nevertheless, the wages account, as a whole, continues to mount, and all the technical advances of the age only serve to counteract to a small extent its preponderating influence on the cost of the manufacture and supply of gas.

It is pleasing, however, to reflect with Mr. Körting on the great benefits which scientific investigation has conferred on the gas industry. We yield to no one in our admiration for the immense good which the learned Professor at Carlsruhe—Dr. Hans Bunte—has done by his personal work, and through his magnetic influence on his pupils and others, in disseminating a knowledge of the principles of the manufacture and utilization of gas. Known and respected by all at the Frankfort gathering, Professor Bunte who has for many years acted as General Secretary to the German Gas and Water Association, was appropriately enough acclaimed there by Mr. Körting as the most distinguished *savant* who had inaugurated the new era in the gas industry which dawned when rule-of-thumb working began to be ousted by control based on ascertained scientific principles. Yet, if we mistake not, Professor Bunte in this matter would be the first to recognize that he had many predecessors and contemporaries—some in this country, some in Germany, and some elsewhere—whose investigations have been equally beneficial. Moreover, many of these men have been engaged in the daily routine of gas supply, which Mr. Körting shows to be more than sufficiently exacting, and yet have found time to make researches on fundamental problems of gas manufacture which are classical examples of scientific and accurate investigation. The new era in the gas industry was not inaugurated by any one man, but by a host of workers scattered in different countries—a few academically trained, but many self-taught. Among them all, however, Professor Bunte will take a very prominent position; and we tender him our hearty congratulations on the dignity of Honorary Membership of its Council which the Association conferred upon him at the recent meeting.

It is pleasing also to note from the reports of the Association's Committees, summarized in another column, that the new Instructional and Experimental Works of the Association have already done excellent work, in both functions indicated by its title. In regard to Instruction, we may hope that the Fuel Department of the University of Leeds may prove at least as successful; while in the investigation of gas coals much also will be done there, and a great deal is even now being accomplished at the Federal Fuel-Testing Laboratory at Zurich. Collateral researches at three such institutions, under such able direction as that of Professor Bunte, Professor Bone, and Professor Constam, should certainly lead to results and conclusions of great value to gas managers everywhere. Whether the aim of the Carlsruhe and Zurich laboratories—the establishment of a basis for the comparative valuation of gas coals to enable dealings in coal to be made according to the intrinsic values to the user of the particular varieties—will be achieved at an early date is very doubtful. It should be borne in mind, however, that the last few years have witnessed the introduction into contracts for coal for steam raising of clauses specifying a standard calorific power, which were unheard of in earlier contracts. It is not, therefore, beyond the range of possibilities that gas-works may yet buy their coal on the basis of a laboratory valuation of the various consignments.

Examination Results.

THE pass lists in the examinations in gas engineering and supply have been issued; and there are two or three noticeable points about them in comparison with the previous year's lists. We might preface these special features by saying that the value of the lists would be enhanced if, in addition to the information as to who are the successful candidates, the numbers were given of the candidates (without mentioning the names of the unsuccessful ones) who entered in each division. To know the proportion of the successes to the total number of candidates would be instructive, as an indication of the assiduity year by year of the students in preparing for the examinations, and would emphasize the need of perseverance on the part of prospective candidates. Judgment as to the effect on success or failure of the stiffness or otherwise of the examinations can be made from the questions themselves, which we are able to publish after the examinations. Subject to the want of knowledge as to numbers who entered, the candidates in the honours grade of gas engineering have done exceptionally well; the total number of passes having been 73, against 51 last year. But that is not the only satisfactory feature. No less than 26 of the 73 have secured first-class certificates, against only 11 of the 51 in the preceding year. We congratulate them. Having regard to the questions, there is the evidence here of an excellent application to studies in the higher branches of gas engineering, manufacture, and chemistry; and it testifies to the efficiency of the educational opportunities offered in the present day—in works, colleges, schools, and technical literature. In the ordinary grade of "Gas Engineering," there were 100 passes, against 104 the previous year. Of the total, 40 succeeded in obtaining first-class certificates, compared with 36 a twelvemonth earlier. In the second class of the ordinary grade, there were 60 passes, against 68 the year before. The new Examiner in Gas Engineering (Mr. W. Doig Gibb) we venture to think has not found the task by any means a simple nor a light one in adjudicating upon the merits of the candidates' work; nor has Mr. J. H. Brearley, the Examiner in "Gas Supply." This division of the examinations has rapidly sprung into popularity among the gas industry's juniors; and the separation of subjects affecting internal structures and processes and external distribution and application has declared itself by the results alone to have been peculiarly appropriate. A year ago 113 candidates were adjudged worthy of certificates—47 in the first class, and 66 in the second class. This year the total of the successful candidates has risen to 139—58 of whom have obtained first-class certificates, and 81 second-class. This is extremely satisfactory and most encouraging. But we do not envy the Examiners their growing tasks. Their chief reward lies in the knowledge that they are doing excellent work for the gas industry. It goes without saying that the expansion of definite technical knowledge among aspirants for official positions in the various branches of work offered by the industry is to the industry's advantage.

A Disaster Averted.

THE serenity with which the Home Secretary last year regarded the prognostications of skilled men as to the effects of the Mines (Eight Hours Act) can hardly longer exist. Last week we were trembling on the verge of a national disaster (just when trade cannot stand the introduction of any further disturbing element) by a threatened complete stoppage in the coal-fields. The Act, as the Miners' Federation have known all along, but as their ministerial allies failed or refused to see, has put a new weapon of offence in the hands of the miners; and they will use it, in accordance with tradition, to their own advantage to the utmost extent. The Home Secretary laughed in the faces of those who were disposed to see anything but benevolence and peace in the Act; but the very bringing of the measure into force on July 1 (save in the Northumberland and Durham coal-fields, where it becomes operative as from the 1st of January

next) has shown that the miners are not willing to allow the masters to work the pits in, according to their judgment, the most economical manner within the terms of the Act, and it has further proved the strength of the men in compelling compliance with their wishes, or, as an alternative, bringing about an industrial collapse throughout the country. The scene of the struggle between masters and men has been South Wales; and the miners there were backed, through the Miners' Federation, with the might of the whole of the miners in the country, though, in most of the other coal-fields so far affected by the Act (excepting Scotland and sundry English pits), conditions for the working of the measure had previously been more or less amicably arranged. But this does not stand for much, when the miners throughout the country would be prepared to hand in their notices on the masters, in any one district, holding firmly to the small amount of freedom given them in working within the four corners of the Act.

The Act invests the mine owner, agent, or manager with the right to extend by one the hours of work on sixty days in the year. It does not say this is to be subject to the men's pleasure; but it allows the masters to use the little latitude thus afforded on any days they choose, irregularly or consecutively, so long as the total number of extra hours does not exceed sixty a year. Though there is this permissive power granted to the masters by the Act, the South Wales miners made up their minds to have a voice in the question of how it is to be applied. In other words, the little relief the masters did obtain under the Act is, the miners claim, to be subject to their own will. If this were admitted by the masters, the provision as to the sixty days' latitude would speedily become more or less inoperative. The South Wales owners also desired to work double shifts, which they assert is necessary to enable the maintenance of the output of coal. But the miners protest against this —or rather their objection to it—is that the greater output following the double shift, would, by the liberation of more gas, greatly increase danger, owing to less time being available for the proper ventilation of mines. The suggestion is that in this respect the work of the Welsh miner is more dangerous than that of the English miner. Those were the points in dispute; and the negotiations between the parties might have ended quite satisfactorily in Cardiff (in the way that fortunately they have done) without the untimely intervention of the Miners' Federation in London, who, just before an agreement was arrived at in Cardiff—ill-advisedly we think—took action in a manner that might have stiffened the backs of either or both parties, by resolving that, in the event of disagreement, steps should be taken to effect a national stoppage. That was a serious threat. The situation was critical; but the parties in Cardiff came to an agreement almost at the twelfth hour, determining to settle the sixty hours' question by a test-case; and, as to the double shift, the owners agreed, providing the men did not raise any local obstacle in any mine where it can be shown that such a step can be applied satisfactorily and without danger, that they would consult the men on the subject before putting it into operation.

So a stoppage that at one time looked inevitable has been averted; and we are all thankful for it. The unrest lately among miners in various parts of the country in connection with the arrangements for bringing the Act into force has been all too palpable to those within the line of observation. Without a stoppage, the power of the men has made itself felt in the several coal-fields in settling conditions that will not be without their effect in maintaining prices at a higher level than would have been the case had this Act never had existence. Midsummer is not the best conceivable time, from the miners' point of view, for a stoppage; and it is earnestly to be hoped that the present sense of comparative safety from a national evil in this respect will not receive an ugly shock in the depth of winter, when the new conditions come to be applied to Northumberland and Durham. Any disagreement then would be a bad thing for the gas industry. The Act has given the miners further scope for the exercise of their strength and power; and, from what has already been seen, the measure is bound, it appears to us, to increase the tension between the owners and the employees. It is wondered if the Home Secretary and his ministerial colleagues are as proud of the work they have collectively done in this matter at the present time as they were before they heard the warning voices of men who are more competent than themselves to form an accurate judgment as to the likely effects of that work.

Leeds Makes an Independent Investigation.

A report to which welcome will be given beyond the Leeds City Council is one which has been prepared by a Sub-Committee of the Gas Committee—viz., Mr. C. F. Tetley (Chairman), and Messrs. Ratcliffe (Deputy Chairman), Brown, Hinchliffe, and Ambler—giving, in pithy form, the information they gathered, on a recent visit, in company with the General Manager of the Department (Mr. R. H. Townsley), to Berlin and Cologne, mainly to inspect the extensive settings there on the Dessau system; and, while on the main object, to pick up by the way other striking information. To Leeds, the report will be valuable for the knowledge and impressions gained by those upon whom chiefly falls the responsibilities of conducting the, from our point of view, most important department in the trading activities of the Leeds Corporation. A stay-at-home policy is not productive of any more good to committeemen and directors than to engineers; getting into touch with the affairs of the larger gas industry than their own particular section of it must broaden their knowledge, and make them more efficient for the discharge of their duties. To the gas industry generally, the report will be of value, not because it adds much to the stock of information on the subjects dealt with, but because it gives independent and up-to-date confirmation of the working of the Dessau system abroad.

The Results.

At Oberspree, Mariendorf, and Cologne, the Leeds deputation found, by personal inspection, that nothing had been overstated as to the working of the system—in regard to labour, make of gas, calorific powe purity, and low nitrogen, carbon bisulphide, and naphthalene content; and they also found that retorts at Oberspree had been at work continuously 800 days and at Cologne 705 days, being still in good condition. This point is one on which information had been awaited with curiosity, as there were grave doubts in the beginning of the working of the system, as to the durability and the costs that would be entailed by wear and tear. In Dr. Lessing's recent report to the Institution Carbonization Committee, it was also mentioned that a statement issued quite lately by Mr. E. Körting, together with reports by Messrs. Prenger and Weiss, indicate a durability of the Dessau retort of 900 to 1000, or even more, firing-days, after which probably only the lower parts of the retorts will have to be renewed. The accumulating information under this head is both interesting and satisfactory. However, the Leeds Gas Committee are not going to pin their faith to any particular system yet. They desire to make experiments on their own account, and ask for permission to erect a suitable number of retorts to enable a trial on a practical scale. But they "are not anxious at present to erect a large installation on any one system, as they are not without hope that one of those that work continuously may attain perfection." If vertical retort settings are erected at Leeds, there will no doubt be a conflux of interest in the working from the professionals of the Gas Department of the Corporation and of the Department of Gas Engineering and Fuel at the Leeds University. Generally, matters in connection with carbonization in vertical retorts seem to have been largely quickened lately in this country. From watching and a distant interest, practical steps towards adoption are being made, and many engineers are contemplating what will be their own next move.

Progress of the Gas Industry.

In another part of the "JOURNAL" will be found the principal portions of a paper read many years ago by Mr. Tadman, a former Manager of the Norwich Gas-Works, on "The Origin and Progress of Gas Lighting." As explained in the introductory paragraph, the manuscript of the paper was placed at our disposal by Mr. Tadman's latest successor—Mr. Thomas Glover—and, but for the crowded state of our columns, the extracts now given would have appeared in the issue containing the report of the proceedings at the recent meeting of the Institution of Gas Engineers, with which Mr. Glover's presidency came to a close. They have lost none of their interest, however, by the slight delay which has occurred in publication—indeed, the interest has been somewhat enhanced by the issue of the last returns as to the gas undertakings of the United Kingdom, which were noticed last week. The historical portions of Mr. Tadman's paper are, of course, well known to most people engaged in the gas industry;

but towards the end he gives some figures from a return made to the Secretary of State for the Home Department in 1822. At that time, the three Gas Companies supplying London—the Gaslight and Coke, City of London, and Phœnix—were making 397 million cubic feet of gas in the twelve months. They carbonized 41,447 tons of coal in 1305 retorts, and had 47 gasholders, with a total capacity of 917,940 cubic feet, and 210 miles of mains. The writer mentions that the old Imperial Gas Company were putting up or arranging for several holders of 10,000 cubic feet capacity at their Hackney and St. Pancras stations; while in 1844 they were erecting a "large gasholder and tank capable of containing 500,000 cubic feet." This was evidently regarded as a great advance; and concurrently with it Mr. Tadman records a very general movement in the direction of providing additional storage by gas companies, either by the erection of new or the telescoping of old gasholders. Could he ever have supposed that the further progress of the gas industry would lead to the production of such gigantic structures as those at New York, East Greenwich, and Manchester? We doubt it; and to have talked about abolishing guide-framing would probably have frightened him. It is difficult, owing to subsequent amalgamations, to compare the carbonizing and other figures given above with the statistics contained in the last returns; but those for the Gaslight and Coke and the South Metropolitan Gas Companies may be cited. The former Company carbonized 1,708,612 tons of coal in 1907, made 18,694¼ million cubic feet of gas, and had 2158 miles of mains; the latter carbonizing 1,215,456 tons of coal, producing rather more than 13,081 million feet of gas, and having 1207 miles of mains. Mr. Tadman presented to his audience an interesting record of progress up to date; and we followed his example, in a less readable form, in the statistics given last week. They furnish evidence, as then remarked, that the gas industry's tale of prosperity shows no signs of abatement, despite the severest competition brought to bear upon it.

Sequel to a Gas Explosion.

There was recently tried in the Dublin Law Courts—the hearing extending over six days—a case which is of considerable importance to gas suppliers generally, as well as to the undertaking particularly concerned in it—the Alliance and Dublin Consumers' Gas Company. The interest attaching to the action has induced us to give in to-day's issue what is to all intents and purposes a verbatim report of Mr. Justice Andrews's summing up to the Special Jury—which we are able to do through the courtesy of Mr. Francis T. Cotton, the Secretary and Manager of the Gas Company. The whole of the facts of the case are set forth in considerable detail in the summing up; and it is not necessary to repeat them here. It may, however, be stated that nearly two years ago a serious gas explosion took place in a drapery establishment in Grafton Street, Dublin, from which much damage to property and personal injury to a domestic servant resulted; and the action was brought by Messrs. Forrest and Sons, the proprietors of the business, to make the Gas Company liable. But in this they were unsuccessful, as the Jury found in favour of the defendants. The ground upon which it was sought to make the Gas Company responsible was that there was negligence on their part and on that of their servants, by reason of which the explosion was caused. It appears that the plaintiffs were having considerable alterations made to their premises; and in connection therewith they desired to have removed three cookers which they had on hire from the Gas Company. One of the Company's gas-fitters was there at the time doing other work; and apparently he was told by somebody acting on behalf of the plaintiffs to disconnect the cookers. This he did; and some time afterwards the explosion took place. Investigation showed that the meter was turned on; and, of course, the gas escaped where the disconnection had taken place. The fitter stated that he first shut off the gas at the meter and tightened the plug; and a porter in the employ of the plaintiffs, whose duty it was to turn the meters on and off also claimed to have shut the cooker meter off on the day in question. The fitter, on the other hand, said he had told the porter that he (the fitter) had shut the meter off. The first question put to the Jury was whether the fitter, when he was disconnecting the stoves and shutting off the gas at the meter, was acting with the Gas Company's authority as their servant; and they found that he was not. No doubt this was sufficient to put an end to the attempt to make the Company liable; but, in addition, the Jury, in answer to further questions, held that there was no negligence in the performance of the work on the part of the fitter.

Fitting Up Show Houses.

The electrical people are keeping a sharp look-out on what gas companies are doing in smart enterprise; and the writer of "Installation Topics" in the "Electrical Times" urges electric light undertakings to take a leaf, or rather several leaves, out of gas companies' books, and adopt similar methods for promoting the consumption of electricity in small and medium-sized property. Here is one instance that has upset our friend. In one of the better class London suburbs, the Gas Company have arranged with a local builder to pipe, free of all cost, any houses he erects. Six such residences have been completed; and the Company have prevailed upon the builder to finish one quite ready for occupation. This house has since been fitted up by the Company with every gas-consuming device likely to be adopted by a tenant. The appliances installed include gas-fires, gas-heated copper, gas-cooker, geyser in bathroom, hot-water circulator in parallel with kitchener, and attractive pendants and brackets in all rooms. These are shown in operation to anyone inspecting the house. A tenant taking the sample house, or one of its neighbours, is invited to have any or all of the fittings exhibited, and to pay for them outright at a substantial discount from the list prices, or to use them under a hire-purchase or rental scheme—no charge being made for the fixing or for the original piping. Bills are printed by the Company advertising the property; and in return for this publicity of his houses, the builder is asked to use the show place as his office, so that he is always on the spot to conduct "victims" [our contemporary's choice of term!] through the place. Such enterprise, it is naturally thought by our envious friends, is "worthy of a better cause" than lighting and heating by gas.

An Electrical Example, and More Gas Enterprise.

The foregoing exhibition of envy at what a Gas Company are doing appeared one week in the "Electrical Times;" and the following week there was great rejoicing regarding a model house that the South Metropolitan Electric Light and Power Company have rented at Hither Green to attract consumers on the St. German's Estate. The model electric installation is said by our contemporary to be an improvement upon the house the Gas Company in another district have provided, in that a qualified lady attendant is always on the premises to interview callers. Most of the houses on the St. German's Estate are of rental values between £32 and £40; and it is this class of householder that it is so difficult to rope-in as electricity users. The model house is a small double-fronted residence rented at £36, and situated at the corner of a road through which the residents on the estate pass from Hither Green Station. It is fitted up with the idea of impressing likely consumers with the cheapness with which "good" wiring can be carried out, and the low cost of current to give "adequate" illumination under modern conditions. We have seen the house, and are not impressed by the lighting. The fittings all look cheap; and there is a poverty of illumination. In the hall is a plain cord pendant, with a 16-candle power Osram lamp. The drawing-room is lighted by a pair of single-drop pendants, carrying 25-candle power lamps; and a three-light cord electrolier with 16-candle power lamps gives, according to the estimate of the electrical writer, "ample" illumination in the dining-room. In the kitchen, bedrooms, and land ing, plain cord pendants with lamps of 16 or 8 candle power are used. There are in all sixteen points of lighting. An outside illuminated sign calls attention to the display within; and every evening from dusk to bedtime all the lights are running, and the blinds are kept up to attract attention. On top of this—and here again we suppose that the enterprise will be considered by our friend as "worthy a better cause"—the writer of "Installation Topics" learns that on an adjoining estate, where a somewhat better class of property is about to be erected on an extensive scale, the competing Gas Company have acquired a six years' lease of a pretentious corner house, with the intention of equipping it with every gas-consuming device likely to be employed in such residences. It is to be under the management of a lady resident. There is a reality about this method of advertising that

should do an immense amount of good. In a show-room, one can make a choice of fittings all right; but a demonstration of lighting and heating there (unless special apartments are provided) is not the same thing as in the furnished rooms of a house.

Federation of Trade Unions.

Some idea of the cost of strikes from the workers' point of view (the loss entailed on employers and on trade generally is, of course, quite a separate matter) can be gathered from the tenth annual report of the General Federation of Trade Unions, which deals with the twelve months to March 31, and which the Secretary (Mr. W. A. Appleton) says "covers the most exciting period of the Federation's existence." In the period referred to, the Federation dealt with 638 disputes, involving 54,962 persons, which in benefits alone cost £123,000. A good balance having been brought forward, it was possible to meet this demand on the funds; but the reserve fund was largely decreased. At the commencement of the year under review, the Federation consisted of 122 affiliated societies; and during the twelve months fifteen other societies, representing 18,860 members, joined, while one society lapsed and several others united forces. There are thus 131 societies now affiliated, the aggregate membership of which is 658,998. In the ten years since its foundation, the Federation has seen the number of affiliated societies trebled and the membership nearly doubled; but Mr. Appleton says there are still many societies whom the sense of solidarity ought to bring inside the Federation, and the movement cannot be complete or really effective until it includes all those competent to join. According to the Secretary, the immediate outlook is not a promising one, for he says: "When the General Federation accepted liability for benefit for the individual dispute, it not only increased the administrative work, but it disturbed the financial basis. The total of the year's disputes may to some extent be accounted for by the state of the labour market; but those who expect any great diminution in the number are likely to be mistaken. The conditions which make for unemployment are little changed; and the rule relating to individual benefit is more generally understood and acted upon. Even with existing liabilities, the possibilities of increasing the reserve will be uncomfortably small; while any addition to the liabilities, without a corresponding addition to the income, would certainly, from the financial point of view, be quite inexcusable."

The Nitrate of Soda Market.

The combination of producers for the restriction of production and shipments of nitrate, which came into operation in April, 1901, for five years, and was at its termination renewed for a further three years, expired on March 31, and was dissolved, owing (Messrs. Montgomery and Co. remark, in their half-yearly report on the nitrate of soda market) to the inability of those entrusted with its renewal to bring all the interested parties into line. Generally speaking, however, it seems that the mass of producers are in favour of combination; and under these circumstances, it is thought there can hardly be a doubt that a way will be found to disperse any difficulties which may now stand in the way of its consummation. It is urged that, with prices slipping away as they have been doing recently, "both the cheap and the dear producer is coming to see that it is a wiser policy on the part of the dear producer to be reasonable and thus save himself from ruin, and in the case of the cheap producer to meet his fellow producers part of the way, and thus, while obtaining a much better price for his output, conserve his grounds, which he would, with a free hand, be depleting in order to try and gain with perhaps double the quantity of nitrate the same annual income." Negotiations for a renewal of the combination are now proceeding unofficially, and considerable progress in this direction is in some quarters said to have been already made, while other authorities would appear to be less hopeful of a successful outcome. One of the difficulties seems to be that about one-sixth of the total production of the nitrate fields is now controlled by German interests, which would naturally be disinclined to submit to control by a foreign committee, though the main question still remains the settlement of the proportions between the companies who can produce nitrate cheaply and those who can only work profitably when the price is fairly high. The present year opened with cargoes quoted at about 8s. 7½d. per cwt., cost and freight; but the price advanced to 9s. 11d. and 9s. 11½d. in the middle of May. From this time, the cargo market began to decline; and by the middle of June no better than 8s. 7½d. per cwt., cost and freight, was obtainable for an arrived cargo. The month closed with prices steady at about 8s. 7d. to 8s. 8d. per cwt., cost and freight, for arrived and due cargoes, and the prospect of a more than usually good consumption for July, by reason of the backward condition of some crops.

Ticehurst Debentures.

The Ticehurst and District Water and Gas Company—one of the progeny of the No. 99, Cannon Street group of promoters—are advertising £1500 of 5 per cent. debentures at par. The advertisements do not give any figures as to the total capital issued, amount of business being done, profits, and dividends paid. These are matters into which anyone contemplating investment should very carefully inquire. There is an application form attached to the advertisement, in which the applicant for debentures requests the Directors to allot him or her the amount applied for, *or any less amount*. These Directors, like most of the members of the Boards of the Companies that have had their origin at No. 99, Cannon Street, are humorists. We have never heard of applicants for any shares in these companies who have been allotted a *less amount* of stock or shares than that for which application is made. But then this invitation for inquiries for these debentures comes from the gas-works, Ticehurst, near Tunbridge Wells. A. E. Locke signs the advertisement as Secretary. There was a time when that name appeared in similar official capacity in connection with the North Sussex Gas and Water Company.

Stamp Duty on Supply Agreements.

In the "JOURNAL" for March 9 last, comment was made upon a case of some importance to both gas and electricity suppliers—in fact, to the trading world generally. It had been before Mr. Justice Channell; and his Lordship was very sympathetic towards those against whom, in the present condition of the law, he had to give judgment. The winning parties were the Inland Revenue Commissioners; the losers the County of Durham Electrical Power Company. The latter had entered into an agreement with Messrs. Snowball, Son, and Co., of Gateshead-on-Tyne, for the supply of electricity for seven years, the terms being a fixed payment per quarter, and 1d. per unit in addition for all current taken. The Inland Revenue Commissioners came along, and contended that the agreement or memorandum related to the sale of goods, wares, or merchandise within Exemption 3 of the Stamp Act; and therefore they held that stamp duty was payable at the rate of 2s. 6d. per cent. of the aggregate amount of the minimum annual payments for seven years. The Company, on the other hand, maintained that no *ad valorem* or other duty was payable; and the question for the Court was whether the assessment was correct. Mr. Justice Channell, it will be remembered, held that it was; but he suggested there was a hardship on the commercial world here, and that an agitation should be commenced to secure relief. The matter has now been before the Master of the Rolls, and Lords Justices Farwell and Kennedy; and they have also decided in favour of the Crown. It would therefore appear that Mr. Justice Channell's advice to seek relief through Parliament is the only possible course open.

A Friendly Act.—Mr. A. Hugh Seabrook on his transfer from East to West (in other words, from the management of the West Ham Electricity Department to that of Marylebone) does not forget his faithful henchman, Mr. H. H. Holmes, whose name occasionally appears in the "Memoranda" and our "Correspondence" columns. Mr. Seabrook has reported to the Marylebone Council that the sale of current for lighting will seriously decrease when the metallic filament lamp becomes better known, and from other directions the department is likely to experience a declining revenue. Mr. Seabrook states that his position is that he has two different and equally important classes of work to do: (1) Overhaul organization, and (2) develop supply. It is necessary for the two to go on simultaneously; but he does not feel it would be wise to tackle the two together single-handed. He has therefore asked permission to engage Mr. H. H. Holmes, Sales Manager at West Ham, who has had great experience in the direction of development, at a salary of £400 a year. The Electricity Committee have decided in favour of Mr. Holmes being appointed.

WILLIAM A. McINTOSH VALON.

An Appreciation.

We mourn to-day the loss of one whose work has left its impression upon the gas industry, who was always loyal to the industry's interests, and whose friendship will always be cherished by those—and they were many—who knew him whether intimately and over long years, or less closely and over a shorter space of time. W. A. M'Intosh Valon is a name that has stood prominently in the industry's work. As he ended a long life, so he became known to his early contemporaries in the industry. He was ever a thinker and a worker—was conscientious, impartial, practical to a fault, genial, and generous in word and deed. There were no two sides to this friend at any time during the long course of years that he was known to the men of the gas industry. What he said was what he believed; and if what he believed turned out to be wrong, he was not above acknowledging it. He always, too, claimed the right, with advancing knowledge and changing times and conditions, to replace previously expressed opinions by those befitting the day and the circumstances. What he claimed for himself in this respect, he did not deny to others. It was this openness of mind, his transparent honesty of purpose, the characteristic justness of his acts, and his fearlessness that endeared him to his friends, and that gained the confidence of those who were his clients professionally.

We go back in memory to the years at Ramsgate, and to those vigorous days when, towards the end of the seventies and the beginning of the eighties, generator and regenerative firing were, as applied to the carbonization of coal for the production of gas, in their nascent stages. In the forefront of the advocacy in those days for the more scientific system of firing retort-settings (following the teachings and the practices of Frederick Siemens) was Mr. Valon, as he was also in the forefront of demonstration work by what he did at Ramsgate and Westgate. It was characteristic of him to get the utmost out of simplicity, before he would step beyond it to any form of complication; and in the early eighties his personal work, the frequent statement of his views, the strength of the case he was able to present, did much in preventing the experimentalists in the new forms of retort-heating from taking flights into complication that would have served no good purpose. His was at once an encouraging and a restraining influence in the work of those days; and an encouraging and a restraining influence that eventuated in much good. How we recall the discussions of the times with an intimate circle of friends, names in which that first come to mind being George and Frank Livesey, John West, Charles Gandon, William Broadberry, Jabez Church, Arthur F. Phillips, Hartley, Sugg, and others—not only on this subject of retort heating, but on many others. His name, too, will always be associated with the stop prepayment meter, and its introduction in places instead of slots. Of him it can also be truly said that, with advancing years, he never was behind the times—in thought, in the formation of ideas, in initiative, and in execution, he lived well to the day and to its purposes.

Before leaving Ramsgate, the services of Mr. Valon had been sought by so many in the gas industry in the capacities of consultant, adviser, and as expert witness, that this to a large extent induced the relinquishing of official service, and the establishing of himself in London, with his eldest son Arthur, in order to secure the complete freedom necessary for the wider professional work that held great interest for him apart from the reward. As an engineer, he was liked because he was practical; as an adviser, because he was conscientious. In parliamentary work, he fought well for the cause to which he gave adherence; and in his word Committees placed a large amount of trust. It is not difficult for Committees, after a little experience, to judge whether a man is purely a partizan, or is making attestation in honest belief. The latter was the characteristic that clung about the name and person of our departed friend. With most of the great gas and water assessment cases that can be recalled as having taken place during recent decades, Mr. Valon was associated. He was not an inventor in the ordinary sense of the word; but in the special paths of the industry in which he walked, he has left behind him a good record, a good name, and many regretting that they will have him no more as pleader or defender, or by their sides as an ally. Sons are in the industry bearing the revered name to which we do honour to-day; that name it will be their effort, by their own work, to maintain as it has been left by him whose loss we mourn. To Mrs. Valon, to sons and daughters, and to the family generally we express the profound sympathy of the whole gas industry in the sorrow under which they are bowed to-day.

The subject of the foregoing appreciation died last Saturday at his residence at Kennington Lees, near Ashford, as the result of heart failure, in his 71st year. Deceased had not been attending so closely to business during the past few months as formerly; but, so far as we are aware, there was no reason to suspect that his services in the special department of his profession in which he laboured would shortly no longer be available.

In early life, Mr. Valon was with Mr. Thomas Cubitt, of Millbank, Westminster, in whose shops he was trained for the profession of a civil engineer. Probably his first work in connection with gas engineering was the superintendence of the construction of a large gasholder tank for the old Equitable Gas Company. He was subsequently associated with his brother-in-law, Mr. David Watson, the Chief Engineer of the London Gas Company; and was afterwards appointed Outdoor Superintendent to the Commercial Gas Company. In 1870, he obtained the position of Engineer and Manager of the Isle of Thanet Gas Company, and superintended their works at Ramsgate and Margate; but, on the purchase of the former and the water-works by the Improvement Commissioners, he became their Engineer. He reconstructed the water-works and introduced the constant supply; and, in connection with the latter work, erected a water tower to serve the higher parts of the town and district. The tank has a capacity of 250,000 gallons; and when it was completed it was regarded as the largest elevated artificial reservoir in England. In 1891, Mr. Valon was appointed Engineer to the Ramsgate Corporation for the purpose of carrying out the sea-front improvements which have added so much to the attractiveness of the popular Kentish watering-place. Early in 1901, he evolved a scheme for connecting the harbour and the gas-works by means of a tunnel, primarily for the conveyance of the coal to the works, and secondarily for the transmission of other material required there or elsewhere. He was a Justice of the Peace for Ramsgate.

When Mr. Valon went to Ramsgate, he had considerable private practice as a Consulting Gas and Water Engineer; and this he gradually increased to such an extent that he decided to devote himself entirely to it. Accordingly, early in 1902, he made known to the Gas and Water Committee of the Corporation that it was his intention to resign his position as their Resident Engineer at the end of the then current financial year. The notification dated from the 25th of March, and took effect in September. The change did not, however, necessitate the severance of his connection with the Isle of Thanet, as he was the Consulting Engineer to the Broadstairs District Council as well as Engineer to the Westgate Estate; and he had the responsible charge of the works of the Gas Company supplying Westgate and Birchington, as well as those of the Water Company serving the district. He was also Joint Engineer with his son, Mr. Arthur Valon, to the Minster and Stourmouth District Councils. After he had severed his connection with Ramsgate, he and his son transferred their office staff to Temple Chambers, London, where they practised as Consulting Gas and Water Engineers. About two years ago, however, they removed to Caxton House, Westminster. To enumerate the many cases in which Mr. Valon had been engaged would be difficult at the moment; but it may be mentioned that in the year 1891 he was retained by nearly the whole of the Assessment Committees of London as chief expert witness against the Gaslight and Coke Company.

Turning to the technical side of Mr. Valon's life-work, he was elected a member of the British Association of Gas Managers in 1872, passed into the Gas Institute ten years later, and was President in 1892. The following papers were read by him:—

1882.—"Experience with Generator Furnaces."
1884.—"Generator *v.* Regenerator Furnaces."
1888.—"Use of Oxygen in the Purification of Coal Gas."
1889.—"Manufacture of Oxygen on Gas-Works, and its Practical Application for Purifying."
1892.—"Royal Commission on Labour." *

He was four times awarded the President's Medal, and once (in 1894) the Birmingham Medal—the last being "for the great services rendered by him to the gas industry." Mr. Valon was a member of the present Institution, and also of the Southern District Association of Gas Engineers and Managers, of which he was President in 1883. Six years later, he read before the Association a paper on "The Oxygen Process of Gas Purification." He was a member of the Society of Engineers, and was President in 1893. His occupancy of the presidential chair of the Gas Institute brought with it, as customary, an honorary membership of the Société Technique du Gaz en France. He was admitted an associate member of the Institution of Civil Engineers on May 4, 1875; and a member of the Institution of Mechanical Engineers in 1880.

The funeral is arranged to take place to-day.

* Mr. Valon gave evidence before the Commission, and it was printed in the "Transactions" of the Institute.

Mr. John Marsland, for many years Manager of the Sowerby Bridge Gas-Works, died last Tuesday night at the age of 76. He became connected with the Salford Gas-Works early in life; and later secured an appointment at Newry. In 1881, he was appointed Manager at Sowerby Bridge; and this position he retained until 1902, when he retired. Deceased leaves a widow and two married daughters.

To prevent the spreading of rails, a special form of tie-rod is suggested by Mr. H. Herden, Chief Engineer of the Buffalo and Susquehanna Railway. It consists of a straight steel rod with bent ends that form spikes for the inside of the rail, and are driven through holes in the tie-plates. With this scheme the gauge cannot widen without breaking the rod or tearing up a tie-plate, either of which would be quickly detected, or shearing the spikes. Such rods might also be used with half ties, one under each rail, giving value to the good portion of removed ties.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 65.)

THE Stock Exchange had a variable time last week. It opened heavily enough, oppressed by the weight of the settlement the week before, to which was presently added grave apprehension of dislocation in the coal industry. But before the close the situation became lighter. On Monday, a depressing factor was the announcement of three failures—albeit small ones—and markets of varied character (from Consols to mines) were down. Business continued very quiet on Tuesday, and the general tendency was dull. Railways were flat in fear of the coal difficulty; but Consols throve. On Wednesday, some degree of improvement was perceptible; and markets which had been kept down by selling orders breathed more freely. Railways were much depressed. On Thursday, the feature was the sharp recovery in Railways upon the settlement (if such it can be called) of the Coal Mines dispute. But whether the postponement of the strike period (for that is practically what it really amounts to) from the summer to the winter season can be regarded as satisfactory in the long run, is another question. However, on the Stock Exchange sufficient unto the day is the evil or good thereof, everybody cheered up, and there was a general hurry to get in first at good prices. Business fell quieter on Friday, and Rails rather re-acted; but some good markets were firm. Saturday's general tendency was also favourable. Consols rose fractionally. In the Money Market, there was a good, steady demand up to the close of the half year, after which the market supply filled up again, and the week closed with very easy rates. Business in the Gas Market was, on the whole, not much more abundant than the week before, but one or two issues exhibited unusual prominence. In Gaslight and Coke, the ordinary was rather quiet, and showed no feature in particular. Transactions were practically unchanged, ranging from 103 to 103¾. The secured issues were but little noticed; the preference being dealt in at 105¼ and 106, and the debenture at 86. South Metropolitan was quiet and unchanged at from 122 to 123. Nothing was marked in Commercials; but the 3½ per cent. rose a point. Among the Suburban and Provincial companies, Alliance and Dublin old realized 17¾, Brentford new 196, British from 42⅞ to 43¼, Bournemouth B 16⅞ and 17, Bromley A 120½ and 121, Ilford A 140½ and 141½ (a rise of 1), ditto debenture 103¾ (a rise of 2), West Ham 121½, and ditto preference 126¾. In the Continental companies, Imperial was active, with transactions at from 178 to 180¼ and one special deal at 176¾, ditto debenture fetched from 96 to 97. Union made from 96¾ to 97¾, European part-paid 18⅞, and Malta 4 1/16. Among the undertakings of the remoter world, Buenos Ayres changed hands at from 13 15/16 to 14 1/16, Cape Town debenture at 80¾ (a rise of 2), Monte Video 12¾ and 12⅞, Oriental 138½ and 138¾, Primitiva 6 15/16, River Plate from 14⅞ to 15¼, ditto debenture 96½ and 97 (a rise of 3), San Paulo 14¼, and ditto preference from 11⅞ to 12¼ (a rise of ¼).

ELECTRICITY SUPPLY MEMORANDA.

Contrary Municipal Views on Policy—Sound and Unsound Finance—Municipal Engineers opposed to Profit Appropriation for Rates—Unremunerative Units for Power—Yet, Still too Dear—Preference for Isolated Plants—Metallic Filaments and Dwindling Revenues.

SOME eight days after the terrific explosion in Manchester—caused by faulty electrical cables, and producing much consternation in and around Victoria Buildings, and an amount of food on a corresponding scale for public reflection—the Incorporated Municipal Electrical Association met in the city under what an electrical contemporary describes as the "clattering" arc lamps in the Whitworth Institute. There was much that was hoary, and little that was new, about the proceedings at the meeting. In the electric supply industry, there is a superabundance of opinion on all the current electrical topics of the day; and where a few folk are gathered together in the name of the industry, there each one must express his well-known unchangeable views—sometimes, we are assured by one veracious electrical recorder, in a "long-winded" manner. Some of the members are municipal councillors; and they come from excellent schools in the matters of verbosity and a liberal conceit, though it is something to be thankful for that all do not get affected with these undesirable qualities. However, with all the talk, there is no getting nearer a common agreement on matters of policy.

In this one meeting, we have a good example of the frailty of human judgment. We have the President (Mr. S. L. Pearce, the Electrical Engineer of Manchester) speaking very well and to the point on the matter of a sounder financial policy in respect of renewals and depreciation. But, on the other hand, he believes the majority of power tariffs extant are remunerative, "although in certain cases they may have involved some remission in the fixed charges to large powers users." Then the Lord Mayor of Manchester thinks more of aids for the rates, and so do a majority of the councillors, than of depreciation of plant. So all through the proceedings there were these contrarieties of opinion on questions of policy. Notwithstanding their position as municipal servants, most gas and electrical engineers in public employ can claim to be as ardent at heart (though the tongue sometimes has to give expression to what the heart does not feel) in regard to proper provision being made for depreciation and renewals while a subject is deteriorating as any technical official in company employ, and as strongly opposed to the principle of taking profits from a concern in aid of the rates, instead of giving the ratepayers the cheapest possible service. Mr. Pearce holds that money appropriated to the rates should be utilized in advancing the sounder financial policy that he has in mind—a policy providing more for depreciation and renewals and lower prices. That the views of councillors, generally speaking, do not incline in the same direction as those of the President, is due in part to the facts that the ease of borrowing dulls their perception as to the necessities of such concerns as these, that the magnitude and diversity of the considerations affecting such undertakings are beyond their comprehension, and that they prefer their acts to be obtrusive rather than otherwise. However, the Gas Department of Manchester and the Chairman (Alderman Gibson) may count upon Mr. Pearce's moral support in trying to get relief for the Gas Department from that incubus of £50,000 to £60,000 which a tyrannical Council compel the gas supply to bear in order that the rates may be relieved, and particularly the rates paid by the largest electricity consumers. The tendency is for rate relief from trading undertakings to grow; and in the face of the profit-grasping section of the City Council, Mr. Pearce makes no secret of his satisfaction that the House of Lords has recently commenced checking that tendency by imposing a 1 per cent. limitation upon Salford in the matter of the profits that may be drawn from the borough gas undertaking in aid of the rates. The Salford councillors, who are not of the way of thinking of the Electrical Engineer of the Manchester Corporation, are in a state of great torment; for, as Mr. Pearce points out, the difference—and the Salford councillors have weighed this difference—between limitation and freedom is as between £6000 and £28,000 per annum. We do admire Mr. Pearce's courage in giving utterance in Manchester to the call to arms in resisting the growing tendency of profit appropriation in aid of the rates as being detrimental to the best interests of the trading concerns.

Then we come to a point on which there is a little uncertainty as to the soundness of this apostle of sounder electrical finance. There is a distinct expansion of view in the electrical industry that it is to power supply chiefly that the industry will in future have to look for increased sales and substantial growth; and an equally expanding view is that the metallic filament lamp has its limits severely defined for promoting consumption. But while Mr. Pearce warns all whom it may concern that it is of supreme importance to consider the power question in all its bearings, and be certain that the financial aspect is sound, and not likely to lead an undertaking into a critical condition, he is not keenly impressed by the argument of the critics that many of the power tariffs are unremunerative, and that the present deficits on power sales are masked by the big surplus on lighting sales. On the contrary, as already stated, he believes the majority of power tariffs are remunerative, "although in certain cases they may have involved some remission in the fixed charges to large power users." That is weak and evasive, coming from the Electrical Engineer of the Manchester Corporation, and from a pleader for sounder finance. Supposing there were no units sold for lighting, and that the total units now sold by (say) the Manchester undertaking were under the power tariff, would the tariff then be remunerative? If not, why not, if the smaller number of power units are remunerative? These being "remunerative," the power business should be profitable without the lighting load. If the prices charged for power (standing alone) can be proved to be remunerative, then why the excitement over, and objection to, the request of ratepayers that the preferential terms granted to large users of electricity should be disclosed? There should clearly be prompt willingness to comply with the request. We hear much about electricity concerns being the property of the ratepayers; we also hear, rather more frequently and conspicuously than is good or pardonable, that the less information the ratepayers receive as to the conduct of the business that is asserted to be their property, the better for the concern. We are not arguing in favour of disclosure; but it is impossible to reconcile the one submission with the other, more particularly when the ratepayers, as at West Ham, have had to pay in hard cash many thousands of pounds to succour an under-rated undertaking supplying electricity to certain power customers at extraordinarily low prices. Mr. Pearce, however, considers that municipalities should not be asked to disclose preferential terms; and naturally there was a chorus of approval from the assembled representatives of municipal electricity supply.

Over this question of cheap units for power, electricity undertakings appear to be between his satanic majesty and the deep sea. The position is shown to be an unpleasant one in a discussion that took place at the meeting on a paper treating of "Cheap Units," by Mr. Councillor A. Sinclair, the Chairman of the Electricity Committee of Swansea. The critics have dealt hardly with Mr. Sinclair, and have flatly told him he does not appreciate the subject upon which he posed as an authority, and that it would be better for him to leave such questions for presentation in future to professional men. This being the position, we will not trouble to follow Mr. Sinclair through his paper. Remember, however, that Mr. Sinclair is Chairman of a Committee managing a municipal electricity concern; and probably, like many others, he gravely accepts the illusion that a high power-load, no matter how obtained, no matter the price, is advantageous to the concern

as a whole. One simple way in which cheap units are obtained for the power consumer is by laying upon the lighting consumer, the full capital costs of the maximum demand on a station—the power consumers reaping the whole of the benefits. There are some central station managers, too, who also skin the costs of everything but the bare charges for generation (sometimes we cannot find the whole of these in material form in the prices that are charged), in their feverish anxiety to secure power customers. But it is interesting to see, from the discussion at the meeting, that the craze for cheap units is not universally approved by the engineers of important central stations, some of whom prefer dealing with figures that they can justify, and over which there is no need for secrecy, nor hysterical protest when asked for the justification. Mr. Lackie, of Glasgow, holds that every electricity consumer should bear his fair share of the capital. Mr. Fedden, of Sheffield, prefers definite prices, and gets them if he can. He finds, we read, that load-factors level up all right at Sheffield, without worrying about individual load-factors. But low as the prices charged are in some places, it is an uncomfortable reflection for station engineers that users are clamouring for lower ones still; and that the intelligence is spreading among manufacturers with good loads that they can do better by isolated plants than by taking energy from the district supply mains. If they can do this, then long-hour and large users of electricity for lighting can do the same. Alderman Higham pressed the point home when he told the meeting that at Accrington it is considered that 0·68d. per unit is too high; that with isolated plant he is himself working at 0·34d. per kilowatt-hour; and that, until the town suppliers can offer something better than this to the millowners, they need not hope for their business. Mr. E. E. Hoadley, the Electrical Engineer of Maidstone, agrees that prices for power are "far too high," and that 1d. per unit is hopeless even in the south. If these expressions of opinion and statements of fact may be taken as omens, with the metallic filament lamps gnawing at the lighting revenue, the prospects of many undertakings must be becoming more and more lugubrious.

The subject-matter before the meeting would not have been complete without a paper, and some references in the presidential address, to the metallic filament lamp. All electrical men think or try to believe, or make believe in their public talk, that the metallic filament lamp is eventually going to be a blessing to the electrical industry. They would be able to speak with more confidence if they could command a higher price for power (which they cannot do), and if for a given sum electricity could offer the same value in B.Th.U's. as solid and gaseous fuel (which it cannot do). The stations that are affected most by the new lamps are those that have little or no day load; and the managers of those stations are the ones who cannot look so complacently and cheerfully upon the effects of the new lamps as their more fortunate brethren. Even the latter are not agreed as to whether the worst effect of the lamps has been experienced. Mr. Pearce inclines to the belief that it has been; Mr. Fedden, of Sheffield, that it has yet to come. The raising of prices for lighting is deprecated; cheaper forms of wiring to gain new custom are forced on attention with a vigour suggestive of snatching at the last straw. Mr. Hoadley was the writer of the paper on the subject read at the meeting; and he does not think matters electrical are going to be very rosy in residential districts during the next few years. He makes the suggestion that heating and cooking should be pushed; but in the accounts of his paper before us, we fail to find that he gives any information as to the extent that the pushing has induced the people of Maidstone to adopt electricity for these purposes. It is hard to live on expectation; but he bids all be of good cheer, and matters will right themselves, though the lane may be long to that happy state. More freedom is, he believes, required. Electricity suppliers always appear to us to have a fair share of that desirable condition; and it rather too frequently imposes its existence upon attention in the shape of deficits in municipal supply accounts, and in other ways. He does not like municipal authorities to be tied down to what he choses to term "silly restrictions;" nor does he like to have authorities competing with gas companies "spied upon" by the officials of those companies at every step to see that the restrictions are not broken. Mr. Hoadley forgets that gas companies are under restrictions—some silly, some otherwise; and that the local authorities (the gas companies' competitors in business) are charged with the duty of seeing that the companies comply with the law. What a silly, anomalous, and monstrous condition of things! The gas companies, in their own defence, have to be ever on the alert to see that they are not placed to any additional disadvantage by the municipality supervising their affairs, and competing with them. Already gas companies are at a disadvantage in this matter; and they do not want to be in a worse position. If Mr. Hoadley were in their shoes, he would persistently practice what he choses to call spying, but which we call being wide awake to one's own interests. And at the present, one particular direction in which gas companies have to keep a sharp look-out is that of public lighting, in which an immense amount of unfairness to both gas companies and ratepayers, is being perpetrated in the so-called interests of the electricity undertaking, and by the aid of the untruth consistently promulgated by a number of electrical engineers and the electrical press, that the metallic filament lamp costs less, and is more efficient for street lighting, than modern incandescent gas-burners.

The depreciating effect on the revenue of electricity concerns that is being brought about by the metallic filament lamp was illustrated during the discussion on Mr. Hoadley's paper, but perhaps most strikingly by Mr. Fedden. Since the advent of the lamp, the lighting-load revenue at Sheffield has diminished by £4000, although only 5000 200-volt, 10,000 100-volt, 420 50-volt, and 144 25-volt lamps have been installed—a very small percentage of the total. To make up for one consumer changing his lamps, Mr. Fedden reckons that three new consumers of a similar demand are necessary—two to make up the revenue, and a third to cover the charges. In regard to heating and cooking, in Sheffield the problem of cheap gas faces the Electricity Department; and, although a canvasser goes round with all kinds of accessories, it is acknowledged to be very uphill work for electricity. Mr. Fedden agrees, however, that the new lamp may be a blessing in disguise. Already it has saved a number of his consumers from going back to gas through the blackening of carbon lamps. The position might therefore have been worse than it is.

NOTES FROM WESTMINSTER.

Opposed private measures are scarce now; and just lately proceedings before Select Committees have been of a comparatively small and scrappy nature. The past week saw nothing in the House of Commons rooms but unopposed gas measures. We are, however,

Dublin Once More. promised one in the Alliance and Dublin Consumers' Gas Bill, which comes before a Committee commencing their sittings to-day. The opponents are hoping to do better in the Lower House than they did in the Lords. They will find in Sir Luke White a Chairman who has already done some excellent work in that capacity. Certain of the witnesses will rejoice in having in Sir Luke a Chairman somewhat different from the noble Lord who presided over the Committee before whom the Bill came in the Upper House. Names could be put to witnesses who will not at all regret the change; and who may hope to cut better figures before Sir Luke than the sorry ones they made before Lord Ludlow. But it may be expected that there will be the same threadbare tale told to the Committee in regard to the evils wrought by the "Metropolitan" No. 2 burner and lower illuminating grade gas. But the Committee will have no difficulty in appreciating and setting aside the fallacies so conclusively rebutted by an extensive practical experience in numerous gas-supply areas. Nor are they likely to reject—any more than other Parliamentary Committees have done—the recommendations of the Departmental Committee of the Board of Trade, and the consistent practice of Parliament in this matter now over several sessions.

Purchase. The Bills seeking powers for gas-works purchase are going through without much trouble between the parties this session. There have been little struggles; but not any of much moment. Within the past few days, the Lisburn Bill has been before the Local Legislation Committee; but there was no opposition, and the Bill goes forward. It will be remembered that the session started with Bills promoted by both the Council and the Company. An agreement, however, was arrived at; and the Company withdrew their Bill, allowing that of the Council to peacefully proceed. On the question of purchase, mention was recently made of the success of the Prestatyn Bill, proposing the purchase of the small private gas-supplying concern in the district. There is not likely to be further opposition on the part of the owners; Counsel having appeared for them on clauses. But in connection with that appearance, it must be said we do not think that the Local Legislation Committee did justice in rejecting the suggestion of Counsel for the owners that, unless the purchase was completed within six months after the publication of the award, the powers of purchase under the Act should lapse. That was absolutely fair. It is not good for the gas-works or the gas consumers that uncertainty should be without limit.

Provisional Orders Confirmation. Quite a long string of Provisional Orders have been before the Unopposed Bills Committee in Confirmation Bills. Nothing of importance has arisen in connection with them. But there are one or two interesting points that may be noted. The Bideford Gas Company appear to have been so successful that they have accumulated an undivided balance amounting, for a small Company like this, to the large sum of £7000. This is too much; the limit nowadays imposed by Parliament is the equivalent of a year's requirement for dividend. The result is that the Board of Trade have arranged for the sum to be dispersed, or rather all but £1200, which is to go to a Special Purposes Fund. The balance is to be distributed among the consumers of Bideford within the next six years, by a gradual lowering of the price of gas. The Bideford gas consumers are to be congratulated over this windfall. In connection with the Compstall Order, objection has been raised to a clause providing that, in addition to 10 per cent. dividends that may be paid in any year, all surplus of profits remaining may be utilized in (if deficiencies exist) making up dividends of previous years that have fallen below 10 per cent. Precedents are to be consulted before the Committee give their decision. It ought not to have been difficult to have produced without delay precedents referring to this matter. Most of the other Orders dealt with capital, land, prices, illuminating power, and the other commonplaces of modern gas legislation.

EXAMINATIONS IN "GAS ENGINEERING" AND "GAS SUPPLY."

Pass Lists.

The Superintendent of the Department of Technology of the City and Guilds of London Institute (Sir Philip Magnus, M.P.) has issued the pass lists in connection with the recent examinations in "Gas Engineering" and "Gas Supply."

EXAMINATIONS IN "GAS ENGINEERING."

The candidates who satisfied the Examiner (Mr. W. Doig Gibb, of Newcastle-on-Tyne) numbered 173—viz., 26 First-Class Honours, 47 Second-Class Honours; 40 First-Class Ordinary Grade, 60 Second-Class Ordinary Grade. The names are as follows:—

Honours Grade.

First Class.

Bamber, G. A.	Higgins, F.	Rendle, C. F. W.	Stewart, E. G.
Berry, A.	Hole, S.	Rice, G. H.	Tooby, C. F.
Bradshaw, J. R.	Howie, W. A.	Robert, H. E.	Wheeler, P.
Cheal, A. C.	Jones, G. B.	Robertson, R.	Wootten, E. T.
Chester, R. P.	Lang, J.	Rogers, H. B.	Wyatt, A. R.
Franks, J. W.	Moore, D. G.	Seymour, C. C.	
Griggs, A. R.	Potts, P. C.	Staley, R.	

Second Class.

Ambler, F. G.	Cockburn, C. R.	Marland, P.	Seaton, A. I.
Barraclough, A.V.	Cox, G. F.	Mattey, H. S.	Shepherd, C. E.
Batt, F.	Davies, D. H.	Metter, G. H.	Smith, B. F.
Blair, W.	Dean, F.	Monk, W.	Sutcliffe, J. G.
Bosher, G. H.	Diamond, C.	Moore, E. S.	Taylor, G.
Brewer, P. P.	Dobson, N.	Nice, A. J. N.	Townsend, H.
Briggs, J. C.	Hartley, D.	Pacey, S. O.	Watson, A. T.
Brown, J.	Haynes, H.	Park, J.	Wellard, L. E.
Brown, J. T.	Holland, E. L.	Porteus, W. V.	Weller, F. H.
Caldecott, F. W.	Jolliffe, W. E.	Ranft, J. H.	Wild, W.
Carter, W.	Kennington, J.	Ruggles, F. M.	Woodward, H.
Clarkson, H.	Lawton, C. L.	Scaife, F. L.	

Ordinary Grade.

First Class.

Ault, W. S.	Eastwood, A. I.	May, H. V.	Smith, M. L.
Barclay, W.	Elcock, F.	Muir, A. R.	Strickland, C. C.
Belton, C. M'D.	Firth, H.	Norris, W.	Sumner, A. W.
Berry, A. G. V.	Giles, A. E.	Oughton, E. L.	Taylor, F.
Bramwell, W. H.	Hill, A.	Ritchie, D.	Trickett, A. B.
Bryan, W. S.	Hodder, H. J.	Robinson, A. E.	Waterfield, E.W.
Bullen, A. E.	Jackson, G. J. F.	Robinson, F. C.	Whitehead, S. E.
Coombs, H. A.	Jenkins, E. K.	Ruffhead, A. E.	Whiting, W. H.
Cross, D. C.	Mansfield, C. J.	Skinner, F. N.	Wilkinson, W.
Dunn, J. W.	Marsden, A.	Smith, H. C.	Wright, E. H.

Second Class.

Bezant, B. P.	Freeman, T.	Mansell, H. L.	Smallman, S.
Birks, C. D.	Frisch, G.	Marsh, R. G	Smart, J.
Bolton, W.	Gladwyn, S. C.	M'Cawley, J. J.	Smith, J. C.
Brown, J. W.	Green, J.	Newby, H.	Sutherland, D.
Burke, E.	Hall, T.	Noden, T. J.	Tayleur, G.
Cansino, J. H.	Halstead, P.	Owen, A. E.	Templeton, W.
Cattell, W. H.	Hardy, F. A.	Parsons, B. F.	Thompson, J. W.
Clark, W. J.	Hayes, R. G.	Pepper, G. J.	Walker, J.
Coles, A. W.	Henderson, J.	Philpot, H. J.	Watson, W. J.
Dawson, S. C.	Hughes, T.	Poole, J. G.	Webb, F. S.
England, A. A.	Kimber, R.	Quantrill, E. A.	Webster, H.
Farrar, E. K.	Kwoh, Sce-Kwain	Rice, R.	Williams, S. J. D.
Ferguson, G S.	Longman, C. H.B.	Roy, B.	Willsmer, N.
Fletcher, W.	Mackie, A.	Savage, W. J.	Winslow, A. D.
Floyd, J.	Mann, H. C.	Searle, J. A.	Yates, A. F.

EXAMINATIONS IN "GAS SUPPLY."

In this section, the Examiner (Mr. J. H. Brearley, of Longwood) passed the papers of 191 candidates—viz., 20 First-Class Honours, 32 Second-Class Honours; 58 First-Class Ordinary Grade, 81 Second-Class Ordinary Grade. The names are as follows:—

Honours Grade.

First Class.

Bell, B. J.	Jones, H.	Reed, J. L.	Staley, R.
Craggs, E. F.	Lamprey, R. H. B.	Rice, G. H.	Staniforth, H.
Durward, E. S.	Morgan, H. E.	Rogers, R. J.	Stewart, E. G.
Hartley, D.	Nicholl, J. W.	Sainter, E.	Sumner, A. W.
Horrocks, H.	Quantrill, E. A.	Singleton, H.	Vere, M. C.

Second Class.

Ablett, E.	Elliott, G. H.	Lung, J.	Simmons, A.
Batt, W.	Gadsby, G. S.	Pacey, S. O.	Stapleton, C.
Bedford, W.	Gilbert, E. W.	Pawson, E. G.	Stevens, A. S.
Broadbent, A.	Grogono, W.	Payne, W. E.	Thurley, C. A.
Browne, P. E.	Holdsworth, C. E.	Pullar, J. J.	Townsend, C. V
Chapman, L.	Hoult, H. K.	Ranft, J. H.	Watson, S.
Clark, A. A.	Kelley, H.	Robinson, H.	Wellard, L. E.
Cotton, J.	Kerdel, H. L.	Rogerson, W.	Winslow, G.

Ordinary Grade.

First Class.

Ault, W. S.	Cattell, W. H.	Highmore, J. G.	May, H. V.
Balsom, S. H.	Caudwell, F.	Hill, A.	Murray, A. J.
Bamforth, F.	Chandler, S. B.	Hodder, H. J.	Musgrove, S. T. S.
Barber, W. E.	Cross, D. C.	Hoyles, L. J.	Pepper, G. J.
Batty, T. E.	Dean, F.	Hughes, G. H. G.	Poole, J. G.
Beal, C. F.	Elcock, F.	Kennington, J.	Roberts, H. E.
Behennor, R. J.	Evans, O.	Lawrence, R. H.	Robson, D. E.
Berry, E. J.	Fagan, E. J.	Lawson, W. A.	Rosevear, C. E.
Birks, C. D.	Freeman, T.	Leigh, F.	Thomas, O.
Bray, S.	Green, S.	Lloyd, A. E.	Twist, G.
Briggs, F. C.	Harding, H. J.	Lumb, A.	Westbrook, W. L.
Briggs, J. C.	Haynes, J. T.	Lupton, J.	Whitehouse, A. G.
Bromage, W. H.	Hazeldine, W. A.	Luxon, R. G.	Wyatt, A. R.
Bullen, A. E.	Hazell, W. B.	Mackie, A.	
Burgess, H.	Helden, R. E.	Marsh, R. G.	

Second Class.

Arnold, P. A.	Eastwood, A. I.	Loftus, L.	Stone, E. W.
Asquith, W.	Everitt, A. E. S.	Mansell, H. L.	Taylor, G.
Bate, W.	Featherstone, E.	Moore, H.	Templeton, W.
Beal, H.	Fiddes, H. F.	Morris, F. W.	Thomas, J.
Bellamy, B.	Gorwyn, C. L.	Munro, J. R.	Thompson, J. W.
Bolt, E.	Greaves, H. J.	Noon, E. H.	Toyne, H.
Bowden, W.	Hardy, F. A.	Offer, H.	Trist, C. J. S.
Brady, W. J.	Hartley, H.	Owen, H. W.	Vaughan, W. G.
Broomhall, W. J.	Hawdon, A.	Oxley, W. B.	Walling, S.
Buckley, A.	Heath, J. R.	Page, E. J.	Walters, B. H.
Buckley, J. E.	Henderson, J.	Peel, R. V.	Ward, R. E.
Burke, E.	Hoare, A. W.	Pierce, E. J. J.	Watson, W. J.
Clark, F.	Holdroyd, G.	Ravenhill, L.	Webb, F. S.
Clarkson, H.	Holloway, R. C.	Roberts, A. B.	Williams, A. T.
Cooke, A.	Horton, A. E.	Rogers, R. E.	Williams, S. D.
Cotton, H. F.	Jolliffe, W. E.	Rudge, C. A.	Willison, H.
Cowley, E.	Kershaw, T.	Shepherd, D.	Willmer, H. W.
Cowley, W. A.	Lake, S. L.	Siddle, W.	Winslow, A. D.
Cutler, W. V.	Langford, C. W.	Simmons, S. W.	
Dean, H. W.	Lea, H. W.	Skinner, F. N.	
Duncan, G. F.	Lloyd, E.	Stevens, B. J.	

ELECTRIC LIGHT AND EYESIGHT.

It may be interesting to put on record a few statements on this subject, collected by Sir Joseph A. Bellamy, the Chairman of the Plymouth Gas Company, in view of his recent speech to the shareholders—see last week's "Journal," p. 984—although some (if not all) of the extracts he read have already found a place in our columns.

As far back as the 1905 Congress of the Royal Institute of Public Health, Dr. Allan Wilson said that his experience had proved to him that electric light did a large amount of serious harm to the eyes.

On Nov. 26, 1904, there appeared in the "Lancet" the following remark: "For some not very clear reason, the light of the incandescent electric lamp seems to be wearying—taxing the muscles of accommodation of the eye; and a good many people complain that reading by the electric lamp gives rise to headache."

On March 6, 1906, the same paper reported Mr. I. B. Marks, the President of the American Illuminating Engineering Society, as having declared that "the glare caused by the modern system of lighting streets and buildings with powerful electric arc lights is largely responsible for the admitted increase in defective eyesight."

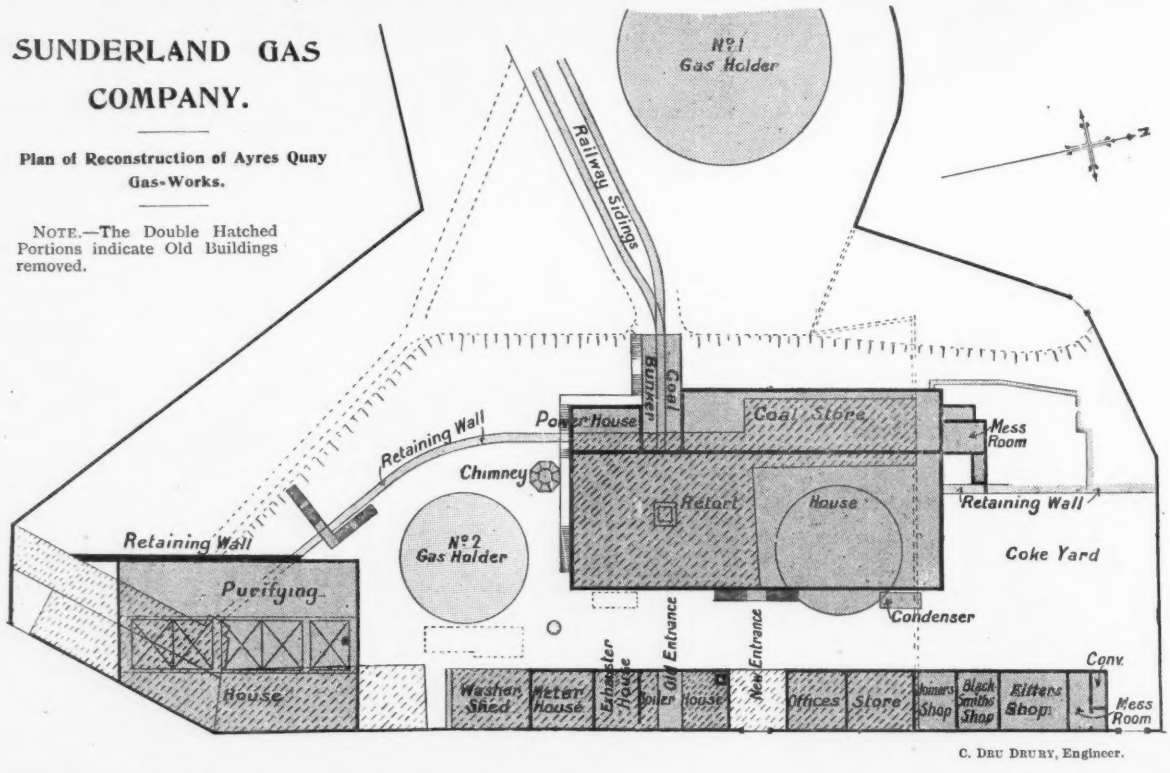
Last year Dr. Samuel Rideal, F.I.C., in the course of his paper on "The Hygienic Values of Gas and Electric Lighting," said: Mental fatigue was tested by the setting of sums at the beginning and at the end of each evening's investigation. There appeared to be less mental fatigue, on the whole, in the gas-lighted room. The effect on the eye of the two modes of lighting was carefully investigated, though it was found necessary to limit the inquiry to tests of eye-fatigue. The tests showed that the sensitiveness of the eye to light as measured by the perception test, diminished markedly under the electric light; but not at all under gas light. The orbicular muscle tests showed that the power of co-ordinating and using the motor muscles of the eyeball diminished to a greater extent under electric than under gas light. The ciliary muscles of the eye also were proved to be more accommodative after three hours gas lighting than after the same period of electric lighting. The retinal test also showed that the optic nerve or centre remained more susceptible when gas was the illuminant. Thus gas had the advantage under all the tests; and all the results pointed strongly to the conclusion that, as used in these rooms, gas lighting was less fatiguing to the eye than electric lighting.

Blowpipe Flame.—It is reported in a recent issue of the "Frankfurt Gazette" that Mr. Harris, an American inventor in Cleveland, has succeeded in producing a flame by the combined use of oxygen and acetylene gases, of exceptionally high temperature. By its use he claims to have made good welds in aluminium, and also that he can in one minute pierce steel plates 2 inches thick. A 12-inch block of steel was cut through in ten minutes—a work which would have required 20 hours in the usual way.

RECONSTRUCTION OF THE AYRES QUAY GAS-WORKS AT SUNDERLAND.

THE site occupied by the Ayres Quay station of the Sunderland Gas Company is not one that gives the engineer much choice in the matter of the disposition of his plant. It is an irregular piece of ground, with a long frontage, a shallow depth from front to back, and at the back the ground rises steeply to a height of about 50 feet above the yard-level. The extent of the site is some 5 acres; so that it will be agreed that, with such a piece of ground to deal with, the engineer finds himself much circumscribed. It is really an extraordinary site. It has its advantages; but it has also its distinct disadvantages. However, the making of the best of his conditions is the work of the engineer; and Mr. C. Dru Drury, the Engineer of the Company, was occupied some months ago in the task of designing works for this particular station of greater productive power and more economical in operation, to take the place of those then existing. The works were of a period in origin somewhat distantly removed from the present—1847—and their capacity was only ½ million cubic feet per day. The retort-house was small, the retorts were small, and the remainder of the plant was of corresponding type. To raise the productive power of the works from ½ to 1½ million cubic feet was the objective the Gas Company had in view; and, by taking in an additional piece of ground at one end of the site, excavating from the hill at the rear, and building up a new retaining-wall where required, this purpose has been accomplished; and the new works are now within a short period of being completed—the whole of the old ones having disappeared save for the two gasholders, the larger of which crowns the hill, while the other is at yard-level. In the plan of the works, the double hatched portions indicate the ground occupied by buildings of the old works; and the remainder represents the amount by which the new buildings are larger than the old ones.

The whole of the buildings are new; and they are all built principally of local bricks, with blue bricks in the jambs of the archways and other members of the structures. The general design is pleasing; and in keeping is the fine high panelled wall forming the long front boundary of the works in Wellington Lane. A large new entrance to the works has been made. Just central to the entrance stands the new retort-house; while immediately to the right and left of the entrance, backing on to the street boundary wall, are the offices, stores, and shops, together with the various plant houses, to be more specifically described later. Farther to the left is the purifier ground.



C. DRU DRURY, Engineer.

THE RETORT-HOUSE AND ADJOINING BUILDINGS.

The retort-house is the central feature of the new works; and more particularly is interest directed to it, seeing that it is the first house in the British Isles in which has been, or is being, erected a bench of Dessau vertical retorts. Thus the new Ayres Quay works will be distinguished and unique in this country in that they will be the first to be absolutely dependent upon vertical retorts for their gas-producing power. For what historical interest this may have, we put it on record here. At the rear of the retort-house is the coal-store, a large receiving coal-bunker, and a power house. An extension from the retort-house is a mess-room for the men. Taking the superficial area occupied by this block of buildings, it is more than double the size covered before. The rear side of the coal-store and the huge coal-receiving bunker necessitated considerable excavation into the hill, as well as the building of a strong retaining wall, forming the back wall of the coal-store and power house.

The retort-house itself was planned of dimensions suitable for any system of carbonization, though, at the time of its design, and the building of the outer walls, Mr. Drury had only in contemplation horizontal or inclined settings. But, as is explained in an earlier article in this issue, events subsequently led to the installation (now well on to completion) of a bench of retorts on the Dessau vertical system. In consequence, the width of the house is more than equal to requirements; but there is this to be said in its favour, that it gives an abundance of freedom on the ground level, both before and behind the bench. Within its walls, the length of the house is 181 ft. 6 in.; its width, 64 feet. The building is in the main of ordinary local bricks; and the contract was carried out by a local firm. The walls are 41 ft. 8 in. high from floor-level to the eaves. The roof has been specially designed to afford ample light and ventilation; and, by adopting a modified Fink truss, extra head-room was gained for the coal-receiving plant of the vertical retort bench. The principals of the roof are 8 ft. 4 in. centres, carrying angle laths of 2 in. by 2 in. by ¼ in. section, and 10½-inch gauge; and upon these the slates are laid—the angle of the roof being 30°. The roof (which formed a separate contract with Messrs. Cutler and Sons) is of light design, and has features that arrest attention. In addition to a central louvre ventilator, there is a continuous open ventilator, 6 ft. in width, on the discharging side of the house; and a skylight with Rendle's glazing, 7 ft. 6 in. in width, running the length of the opposite side to provide light for the operations above the top of the bench. At the centre of the roof, is a strongly framed dormer, to accommodate the coal-elevator head and a coal-screen. This dormer is carried upon two special principals, and is also provided with louvres and skylight of ample character. As before remarked, the house has been constructed for the production of 1½ million cubic feet of gas per day, as compared with the ½ million formerly produced, which means the trebling of the output. The chimney shaft is at the southern end of the house. It is a fine piece of structural work, octagonal in form, 130 feet in height.

COAL STORAGE AND DELIVERY—A FERRO-CONCRETE RECEIVING BUNKER.

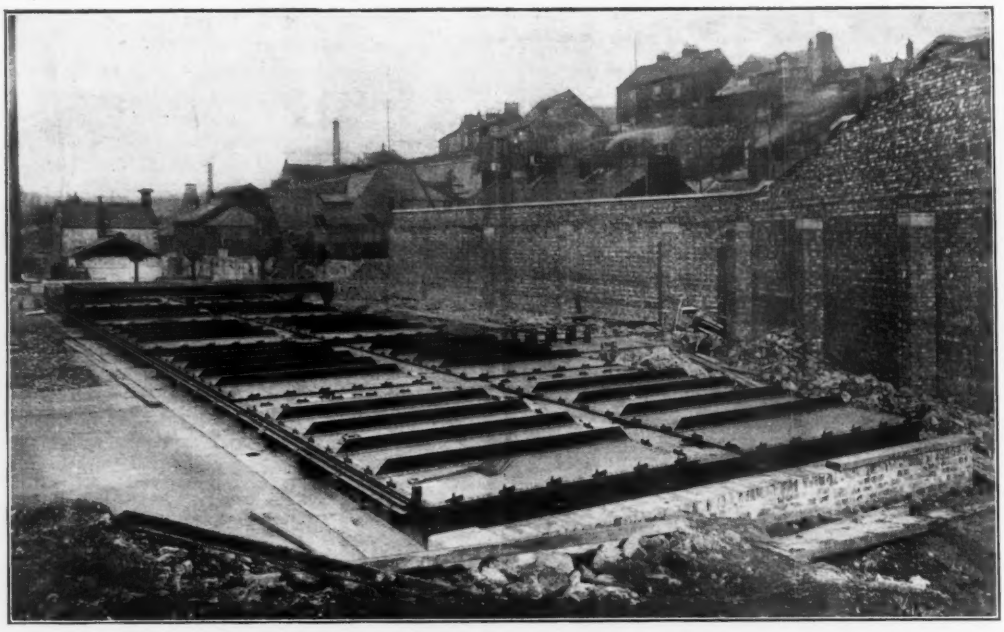
With regard to the coal delivery and storage arrangements, the hill at the rear of the site over which runs the works' railway sidings limited the scope of the engineer in drawing his plans; but an inspection of the work carried out shows that he has made good use of the natural conditions of the site to secure the most economical handling of the raw material. The coal-store—extending longitudinally on the rear side of the retort-house from

Ayres Quay (Sunderland) Gas-Works—End View of the Retort-House, with Power House and Ferro-Concrete Coal-Bunker.

the large coal-receiving bunker—is 25 ft. 9 in. wide, and 129 ft. long. It has a storage capacity of 1600 tons; and, in all, the storage will be equal to fourteen days' maximum consumption. Mr. Drury is manifestly a believer in plenty of light; and here again we find a part (running lengthwise) of the roof with Rendle glazing, in order to give plenty of light in the store. As a matter of fact, without this top glazing—with the division wall of the retort-house on one side, and the retaining-wall on the other—the store would be ill-lighted. The floor of the store and that of the power house, stands well above the ordinary works' level.

The receiving coal-bunker is worth special mention. It is a massive piece of ferro-concrete work on the Hennebique system, as will be remarked by the side view in one of the photographic reproductions. The bunker has a working capacity of no less than 200 tons. The internal width of the bunker is 14 ft. 3 in., and the top, or deck, is from front to back 48 feet. The floor is an incline (at 40°) running from the top to the bottom, and ending at the entrance to the coal-breaker. The top of the bunker is some 50 feet above the ordinary yard level, and will be covered over by a galvanized iron building on steel framework. The hopper bottom is 7 inches thick; the sloping floor, 6 inches thick; the sides, 4½ inches thick; and the deck, 3½ inches thick—the whole being in reinforced concrete. The bunker is carried on twelve ferro-concrete columns. The incoming railway waggons will be shunted by the engine on the sidings on the hill to the end of the bank, and then hauled by a capstan over the bunker, dropping through bottom doors their contents direct into the coal-bunker. From the bottom the coal can be fed into the coal-breaker by a jigging screen, which bye-passes all small coal; and an automatic feeding gear fixed to the bottom of the hopper gives the regular feed required, and prevents the jigger from choking. The coal passes from the breaker to a band conveyor, which runs in a ferro-concrete tunnel in the stores; and this conveyor will deliver the coal into the boot of the elevator running into the retort-house. The coal-store will be filled by tipping-skips, which run on tracks fixed to the roof principals; and these skips will be filled by shoots fixed to the sides of the ferro-concrete bunker. When it is desired to take coal from store, the breaker in the store will be used; and this will be supplied by an automatic feeder placed in the coal-store floor. The broken coal will then pass down a shoot into the elevator boot. The elevator, breaker, and feeder will be protected by a steel shield having a slide-door in the front, which admits the coal to the jigger. The coal-store breaker will be placed in such a position that, when the slide-doors in the ferro-concrete bunker are opened, the coal will naturally fall through without handling; that part of the store nearest the bunker being filled with coal. The breaker and jigger under the bunker and the band conveyor will be driven by an electric motor placed in the space under the bunker; and the elevator and coal-store breaker, will be driven by a separate motor, placed in the opening for the elevator in the retort-house wall. Clutch gear will be provided, so that the coal-store breaker may be

Shell of the New Retort-House and the Old Gasholders from the East Side of Wellington Lane.



New Purifiers at the Ayres Quay (Sunderland) Gas-Works.

thrown out of gear when the elevator is taking coal direct from the bunker emergency plant. In the event of the coal-handling plant getting out of order, the coal can be taken from the stores through openings in the wall, and fed through shoots which screen the coal; the small coal falling into waggons which are run into the hoist at the end of the house. They can then be lifted to the top of the continuous hoppers over the bench, and run along a light railway, discharging the coal into any part of the hopper. Drawings accompanying the article on the Dessau settings (p. 25) will assist in illustrating this description.

Equipment of the Retort-House—The Dessau Verticals.

The coal-handling plant is equal to about 25 tons per hour; but the part in the retort-house, and the coke-handling plant, are described in the separate article treating specially of the first installation of Dessau vertical retorts in this country, and in this new retort-house at the Ayres Quay works. But it may be mentioned here that the coal-handling plant, together with the coke-hoist for feeding the hopper for supplying the producers of the Dessau settings, has been so designed that the whole of the work, when the retort-house is fully equipped, can be done, if necessary, by the yard men, in an ordinary working day, and thus escape the necessity of night-work in connection with the handling of material. The contractors for the coal and coke handling plant are Messrs. Graham, Morton, and Co., of Leeds.

The Power-House.

In connection with the retort-house plant, Mr. Drury has cast his choice for electrical driving. In the power-house, there will be the generating plant, the central features of which will be two National gas-engines, each of 68 brake horse power, connected direct to a 40 kilowatt dynamo. One set will generate all the current (at 220 volts) required; and the other one will serve as a stand-by. The dynamo and electric plant are by the Sunderland Forge and Engineering Company. The energy, as previously mentioned, will be used for operating the coal and coke handling plant, including the coke-hoist for feeding the coke-bunker over the charging-floor for serving the producers. The other plant—such as the exhausters, the washer-scrubbers, and the pumps—will be driven by steam-engines.

From Condensers Onwards.

Before leaving the retort-house, it may be mentioned that there will be fixed a 10-inch retort-house governor (Cowan type) by Messrs. Parkinson and W. & B. Cowan. Outside the house it is seen that a good coke yard has been provided, in which will be the coke-hoppers, and sorting screen, described in the special article on the vertical retort installation. In front of the retort-house, near the coke yard end, is being erected a Morris and Cutler water-tube condenser, of 1 million cubic feet capacity. Attention is next directed to the long range of buildings to the right and left of the main entrance to the works. The whole of the buildings are 30 feet from front to back. The range that is on the right as the works are entered occupies a total length of 158 ft. 6 in. This range is divided into offices, stores, joiners' shop, blacksmiths' shop, fitters' shop, mess room, &c. The shops are being equipped in a manner to make the works self-reliant for repairing work. The machine tools in the shops will be driven by a gas-engine.

On the left-hand side, as one enters the works, the range of buildings is 139 ft. 6 in. long. Of this length, the boiler-shed occupies 43 ft. 6 in.; the exhauster-house, 22 ft. 9 in.; the meter-house, 30 ft. 9 in.; and the washer-shed, 42 ft. 6 in. The plant will be (excepting the exhausters) in units of 1 million cubic feet; and the first section is now being erected. In the boiler-house, there are two Cornish boilers, 22 feet long by 5 ft. 6 in., fitted with Wilton's breeze furnaces. The boilers are by the Hebburn Boiler Company, Tyneside. In the exhauster-house, there will be two sets of Waller's steam-driven exhausters, each of 80,000 cubic feet per hour. In the washer-shed, there are a Livesey washer by the Whessoe Company and a "Standard" scrubber-washer, each of a million cubic feet capacity. The meter-house contains an 80,000 cubic feet per hour station meter, removed from the Company's Hendon station, and re-erected here by Messrs. Parkinson and Cowan; the drum having been re-sheeted. The governors are by the same firm—one an 18-inch, and one a 12-inch.

The purifiers are in a single range in the open, and are located hard by the buildings just referred to, as seen in the plan; being flanked on either side by covered revivifying-sheds for dealing with the oxide—oxide being the only material that will be employed, and the only material that is required with such a low production of sulphur compounds in the gas from the Dessau vertical retorts. The purifiers are divided into five boxes, with dry seals. The dimensions of each box are 20 ft. by 25 ft. by 6 ft. deep; four working with a Weck centre-valve, and one with ordinary valves. The boxes are all fitted with Spencer's hurdle grids. For lifting the covers, a Hovey crane has been adopted. The purifiers were constructed by the Whessoe Company.

The Gasholders.

The two gasholders are really the only parts of the station that remain of its old equipment. The larger one is situated on the hill at the rear of the works. It is a four-lift holder, of 100 feet diameter. Formerly, it had only three lifts, one of which was rope-guided; and now a second rope-guided lift has been added by Messrs. Ashmore, Benson, Pease, and Co. (making the four). While this work was in hand, the holder was thoroughly overhauled, and the framing stiffened. In its elevated position, the structure is much exposed; but there has been no trouble with the rope-guided lifts. The second holder is at the yard-level—a three-lift one, 60 feet diameter. The storage at the station is altogether only ¾ million cubic feet.

An old covered gasholder tank forms the tar and liquor well.

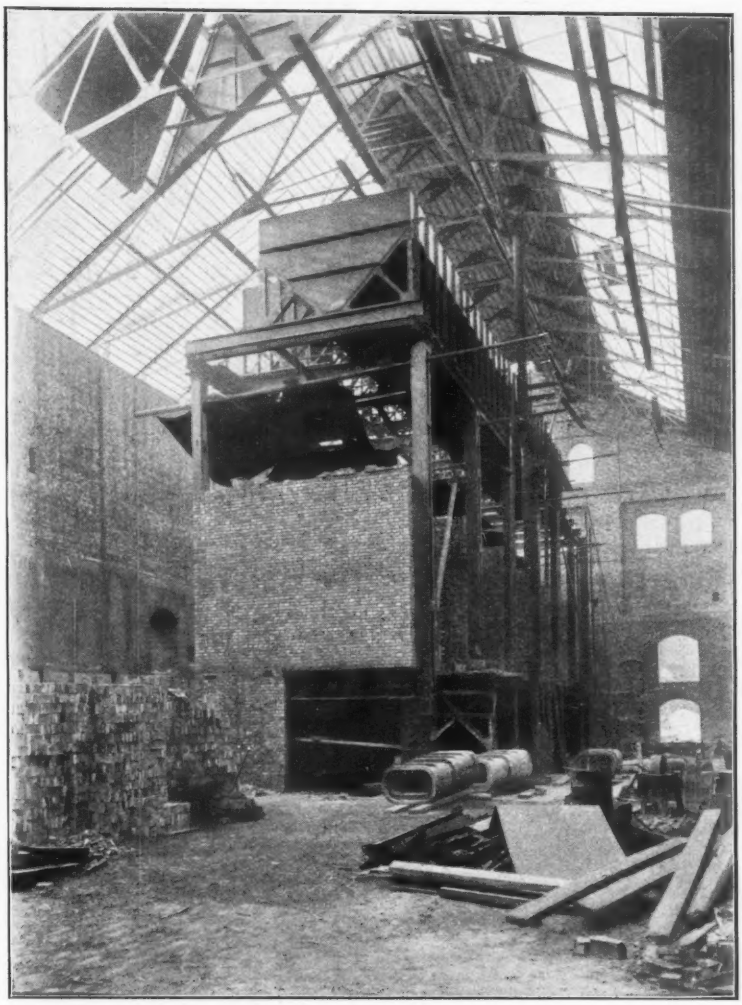
The works' mains are 18-inch, except up to the inlet of the condensers; and to that point they are 20-inch.

The whole of the works—with the exception of the ferro-concrete coal-bunker, and, of course, the bench of Dessau verticals—were designed by Mr. Drury, with the assistance of Mr. H. H. Collett, the Chief Draughtsman, who prepared all the drawings and specifications, and took the photographs which illustrate this and the special article on the Dessau settings. Mr. A. E. Ruffhead has been the Clerk of Works since the commencement of the reconstruction in September, 1907.

There is still much to be done to complete the works. But all the plant is now well in hand; and gas making will be in progress in time for next winter's season. There is no doubt that Mr. Drury has made the best possible use of the peculiarly shaped and environed site at his command. For the interest afforded by him on the occasion of an inspection of the work in progress, our thanks are due.

THE FIRST INSTALLATION OF DESSAU VERTICAL RETORTS IN ENGLAND.*

THE Ayres Quay gas-works of the Sunderland Gas Company will, in a very few months now, illustrate in a notable manner and degree the truth of the saying that the old order changeth and giveth place to the new; and part of the new here will be on the most modern principles, and be representative of the system that first successfully demonstrated the economy in operation, and the economy expressed in improved quantitative and qualitative results, of the application to the carbonization of coal, for (primarily) gas production, of the natural law of gravitation. The original intention of the designers of the Dessau system of carbonization was to derive from the setting of retorts vertically that economy in working which, *primâ facie*, appeared to them should be obtainable by the utilizing of the weight of the coal for charging, and the weight of the spent charge for discharging, if a proper combination of parts could be devised that would make the whole a workable and an efficient carbonizing plant. The designers of the system worked to better end than that of which they were originally cognizant, or had conceived to be possible. It follows that until the setting was brought in all its features to a working perfection for carbonization, the effects could not be ascertained or measured; and then for the first time we learned that a full charge (which can only be economically obtained in a vertical retort, or a retort set at a sharp angle, or by projection in a horizontal retort) carries with it not only economy in labour, but a high make of gas per ton of coal carbonized, with, according to system, other attendant advantages of which the gas-maker had theretofore been robbed by the high temperatures to which he had had recourse to improve the volume of his gas production and to lower his fuel account. The advantages gained by the former method of high temperature carbonization and comparatively shallow charge were to an extent discounted by the disadvantages coincidently brought into existence. The Dessau vertical retort system showed us that these disadvantages could be



Front View of the Vertical Retort Bench at the Ayres Quay (Sunderland) Gas-Works.

largely and constantly annihilated, and the losses they occasioned retrieved. With the first introduction of the Dessau system into this country, full acknowledgment must be made of what the originators of, and workers on, it have taught us. It is only right to give honour where honour is due; and all the success that the owners of the Dessau system have achieved in introducing it into gas-works on the Continent is their due.

A BENCH OF SIXTY VERTICALS.

It is, as our readers are aware, a bench of the Dessau vertical settings that is now nearing completion at the Ayres Quay Gas-Works of the Sunderland Gas Company; the Directors having adopted the system on the advice of their Engineer (Mr. C. Dru Drury), which advice, and the general lines of the new works scheme, had the approval of Mr. J. H. Cox, who, with fifty years' faithful service as his record, still retains his office as Secretary and Manager. His interest in all the affairs of the Company remains unabated; and to him all matters of construction and policy are still finally referred. Mr. Cox, by the way, has seen numerous changes within the walls of the manufacturing stations of the Sunderland Gas Company. But that which is now being brought about is the greatest change of all. This first bench of Dessau verticals in England will have a unique advantage. The old works on the Ayres Quay site have been razed to the ground; and very shortly a new complete works will have been brought into being from the plans of Mr. Drury. The only carbonizing plant upon the works for some time to come will be of the Dessau type; and possibly—if working justifies extension—there will be no other form of retort-setting on the works until (if ever) a new order of things supersedes that of which we have now knowledge. This being so, the working results here will, and under British conditions, have perfect independence, and cannot possibly be mixed up with the products of carbonization under any other system. The results obtained under such circumstances will be valuable, indisputably reliable, and reproducible; and the gas profession will await them, from the time the installation is brought into operation in the autumn, with no ordinary interest. This, it should be emphasized, will be the first installation of vertical retorts of any kind in this country at work on the large scale; and the Ayres Quay Gas-Works will be the first in this country

* See also an article on the Ayres Quay Gas-Works of the Sunderland Gas Company, page 22.

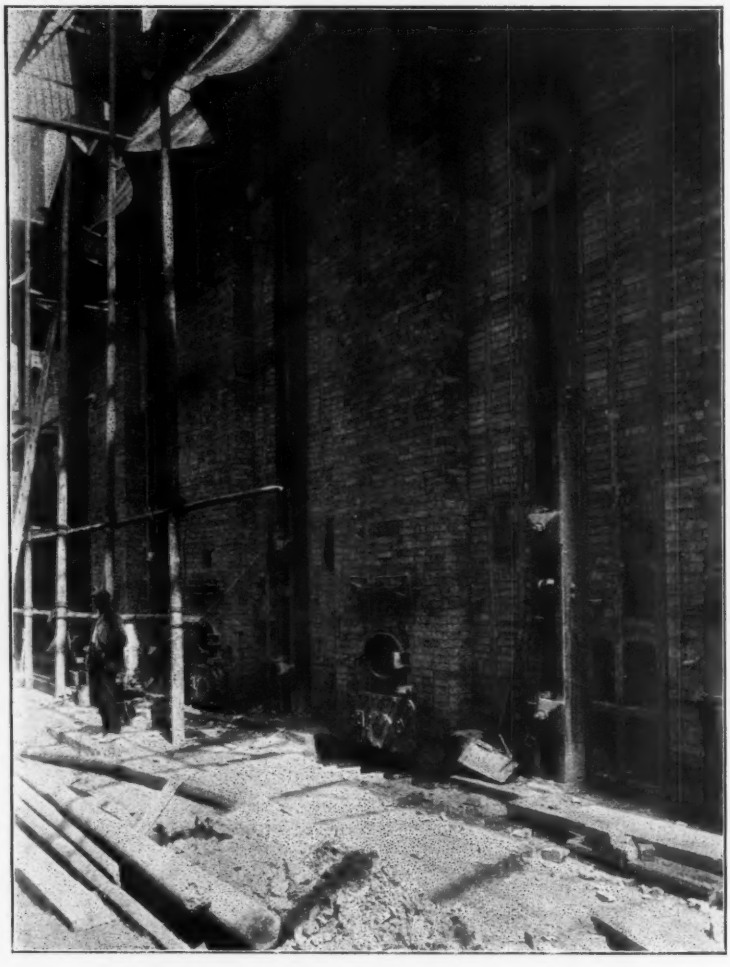
to rely solely upon vertical retorts as the centre and base of its operations.

The New Retort-House.

The new retort-house in which the Dessau bench stands was designed and built for the accommodation of machine-worked horizontal retorts or inclined settings. This in itself is an interesting fact; for it indicates that at the time of design, and of the partial erection of the building, Mr. Drury had not seen anything sufficiently attractive about the results of the working of vertical retorts to justify him entertaining, in the interests of his Company, any revolutionary departure from common retort-house practices. Before, however, it was necessary to equip the house (there being no pressing need owing to the heavy cloud of depression over the local shipbuilding trade), there was opportunity for thoroughly investigating the claims of the Dessau system; and, to cut a long story short, there are now nearing completion six beds of ten 4-metre (13 ft. 1½ in.) retorts, as portrayed in the illustrations, reproduced from photographs taken at different periods during construction. The new house is really more commodious than is requisite for vertical settings; but, as has just been remarked, it was designed for settings that would have required the greater width of building. The consequence is that at both back and front of the bench, there is an amount of spare space, as the work is mainly done on top and below the retorts. But there is no disadvantage in excess space, as it means plenty of freedom for any of the operations attaching to the working of the bench. The internal dimensions of the house are 181 ft. 6 in., by 64 ft. wide; and, in addition to the sixty retorts now being constructed, the building is equal to accommodating an additional five beds of tens, subject, of course, to the experiences with the first six.

Some Particulars of the Vertical Settings.

The ground space occupied by the bench, including the end piers, is 90 ft. 6 in. by 17 ft. 6 in. from back to front. The total height of the bench to the top of the coal-hoppers is 40 ft. 4 in.; and to the top of the bench, or the charging-floor, 21 ft. 6½ in. Between the top of the bench and the bottom of the hoppers, there is working headroom of 9 ft. 7 in. The foundation for the



Producer Side of the Vertical Retort Bench at the Ayres Quay (Sunderland) Gas-Works.

bench is a solid bed of concrete, about 92 feet long by 20 feet wide, with extensions for the main flue and hot-coke conveyor. The buckstays, girders, bracings, and steelwork generally are all of substantial character for their respective purposes. The brickwork of the bench is 90 ft. 6 in. in length and 17 ft. 6 in. wide, and has a height of 21 ft. 6 in. from the floor-level. The width of each bed between the division walls is 13 ft. 2½ in.; and in this space are accommodated ten tapered retorts, each having internal dimensions of 22½ inches by 9 inches at top, and expanding to 27 inches by 13½ inches at bottom—the length being 13 ft. 1½ in. (4 metres). The retorts are constructed in half lengths, and are supported on heavy cast-iron plates, which are in turn carried on a substantial girder framework, with a clear way beneath of about 6 ft. 6 in. This forms a sort of subway under the retorts, and between the lower part of the producers and the front of the bench, as shown in one of the photographs. The front of the subway is open right along the bench, save for the presence of the buckstays. At the back of the bench are the producers, of which there is one to each bed, extending down to the floor-level, with the boiler underneath. Going to the rear, it is seen that all the air-regulating and clinkering-doors are in handy and convenient positions, and that provision has been made for a steam supply to the retorts, should the Engineer desire to supplement his make.

The internal construction of the beds is of the type that long and extensive experience on the Continent has shown to be the most appropriate for this form of setting and working. The retort-charging doors are operated in the usual manner; but the bottom discharging-doors are opened and closed by means of gear actuated from a position beyond the bench, as shown by one of the drawings. This is an important feature, as it allows the retorts to be discharged with ease and celerity; and the attendant is protected from any excessive heat.

Coal-Feeding Arrangements.

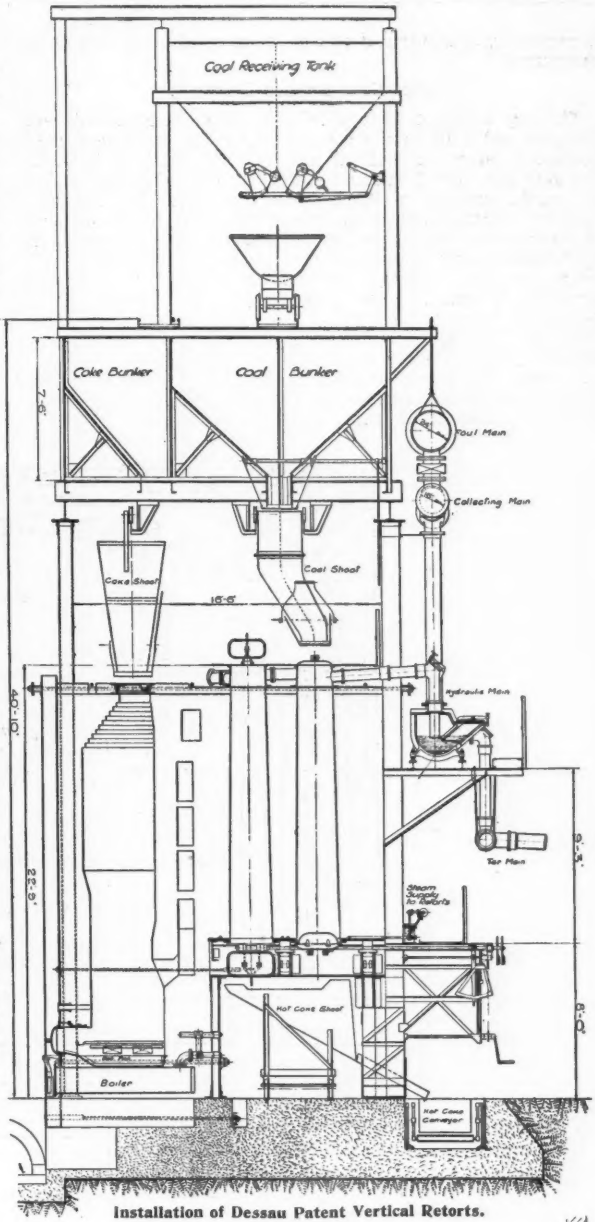
The coal supply for the bench is taken by an elevator either from a large ferro-concrete coal-receiving bunker through a coal-breaker at the foot, or from the store running longitudinally at the rear of the retort-house. In the centre of the roof of the retort-house is a dormer, accommodating the elevator head, as well as a rotary screening-drum. The elevator delivers the coal into this screen; and the material is separated into two sizes—large and small, which are delivered into their respective receiving-hoppers located in the roof above the level of the storage bunkers. The overhead storage bunkers extend the entire length of the bench, and have a capacity equal to 24 hours' supply for the 60 retorts. They are supported on cross girders carried from

the buckstays, and have a central diaphragm dividing them into two equal compartments for the storage of the "large" and the "small" coal. Trolleys, running on a central track, are used for filling both compartments of the bunkers from the receiving hoppers. The trucks are run by hand under the latter, filled by gravitation, and are then discharged sideways into either compartment of the bunkers. The retort-charging shoot (which is fitted with swivel gear by means of which it is rotated to serve either of the two lines of retorts) traverses a rail-track suspended below the bunkers; the shoot being provided with a diaphragm corresponding to the division in the bunker, so that a stream of large and a stream of small coal are simultaneously charged into each retort—thus forming in each two vertical columns of rough and small. This is not considered to be always necessary with the 4-metre verticals; but Mr. Drury decided to adopt the idea (which it will be remembered was first applied by Herr Körting to his 5-metre retorts at Berlin) to be on the safe side in regard to the pressure in the retorts.

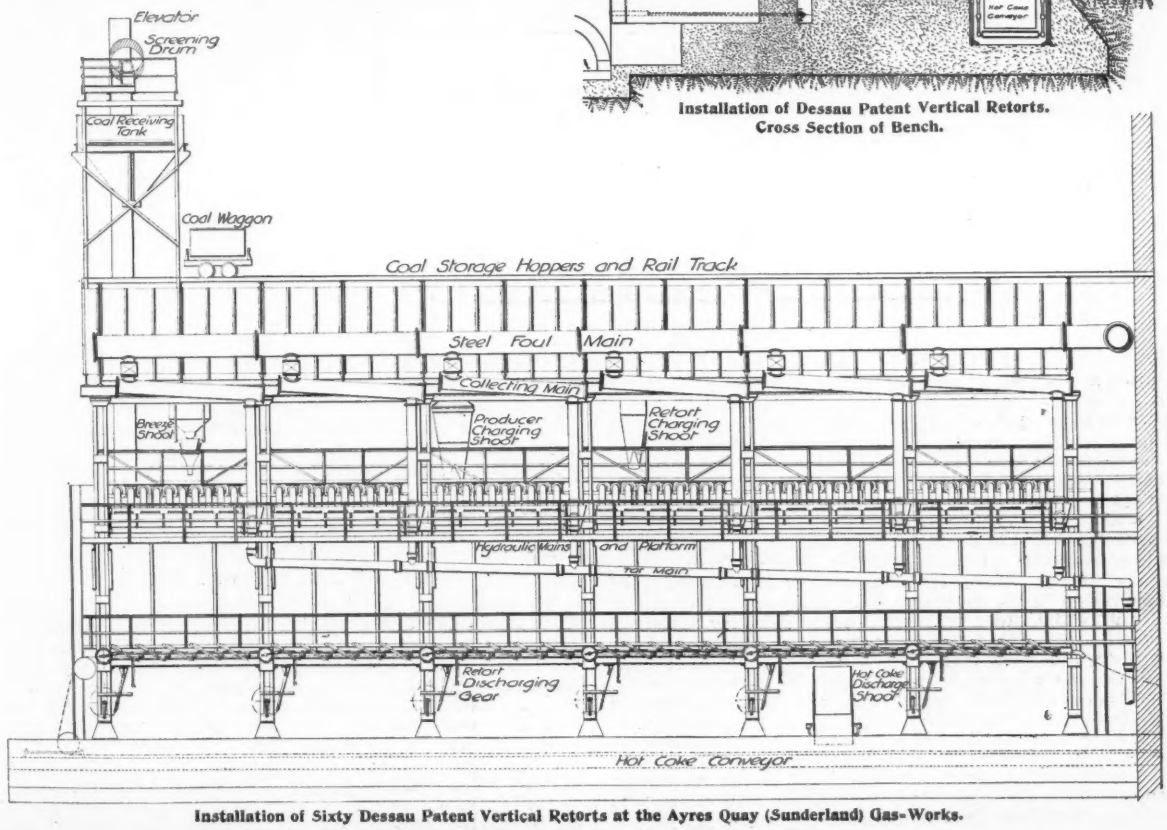
The charge per retort will be 10 to 11 cwt., with two charges per 24 hours; so that the six beds will be about equal to 63 tons per day. Should the working induce the Directors of the Gas Company to erect the further five beds that the house will accommodate, the total quantity of coal the eleven settings will be capable of carbonizing per 24 hours will be 115½ tons, or thereabouts. There may be some question as to why the Company did not adopt the 5-metre (16 ft. 5 in.) retorts, in which the charges are correspondingly greater than in the 4-metre ones as introduced at Sunderland. The reason is that, while we are under illuminating power restrictions in this country, working on the Dessau system, the shorter length retorts will give the better results.

Coke Plant.

The hot coke, as discharged from the retorts, will be received upon a travelling sloping shoot, running on rails under the bench, which shoot will direct the coke into the conveyor carried in a culvert just beyond the front buckstays of the bench. The hot material will be conveyed through a quenching device, and then be delivered up an incline outside the house into an elevated coke-hopper, or through doors in the conveyor trough for stacking in the yard. The portion delivered into the coke-hoppers will be sorted into three sizes—breeze, small, and large, ready for loading for sale or for delivery into tipping trucks, for use in the bench producers. The service of coke to the producers is by means of an electrically driven hoist, which carries the trucks to an overhead track provided on the top of the coke-storage bunkers, which are of similar construction to the coal-bunkers, and have a capacity equal to serving both the present and future duplicate bench with fuel for twelve hours. A mono-rail track extends above the producers; and upon this is carried the coke-charging shoot, which, after being filled by gravitation from the storage bunkers, is traversed to serve any producer as required. There is also a breeze bunker, to contain sufficient breeze for the completed installation of 110 retorts for a period of twelve hours;



Installation of Dessau Patent Vertical Retorts. Cross Section of Bench.



Installation of Sixty Dessau Patent Vertical Retorts at the Ayres Quay (Sunderland) Gas-Works.

a small quantity of breeze being dropped into each retort before the coal charge is introduced.

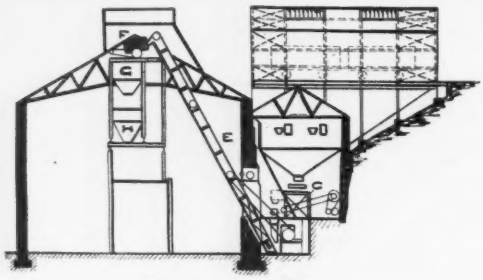
Travel of Gas from the Retorts.

The bench mountings are, as will be seen from the drawings, very simple in character. In the first place, Mr. Drury has incorporated a 10-inch retort-house governor of the Cowan type. Beyond this, it need only be mentioned that the take-off pipes from the mouthpieces are 6 inches in diameter, and are sealed in hydraulic mains of large capacity, each main serving one bed of ten retorts. The hydraulic mains are provided with a longitudinal sealing diaphragm, by means of which a sealed outer chamber is provided, allowing the introduction and withdrawal of the "pitch-pans" without stopping gas making. A separate "pitch-pan" is placed under each dip-pipe; and the tar and liquor overflow is regulated by means of "Drory" valves. From the hydraulic mains the gas passes through 10-inch steel pipes into 16-inch diameter collecting mains; thence into a 24-inch diameter foul main, reduced to 20 inches, extending around the retort-house to the inlet of a Morris and Cutler water-tube condenser, specially designed to deal with the gas produced from this installation.

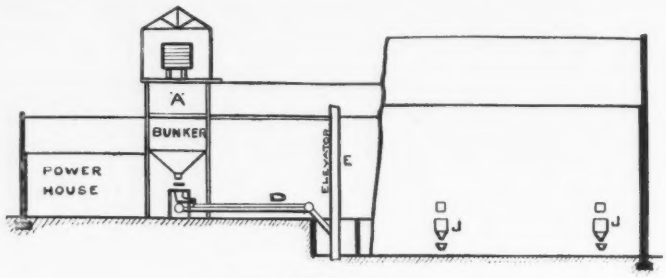
Access to the various parts of the bench is obtained by a series of stairways and platforms of ample and very convenient character.

British Work and Contractors.

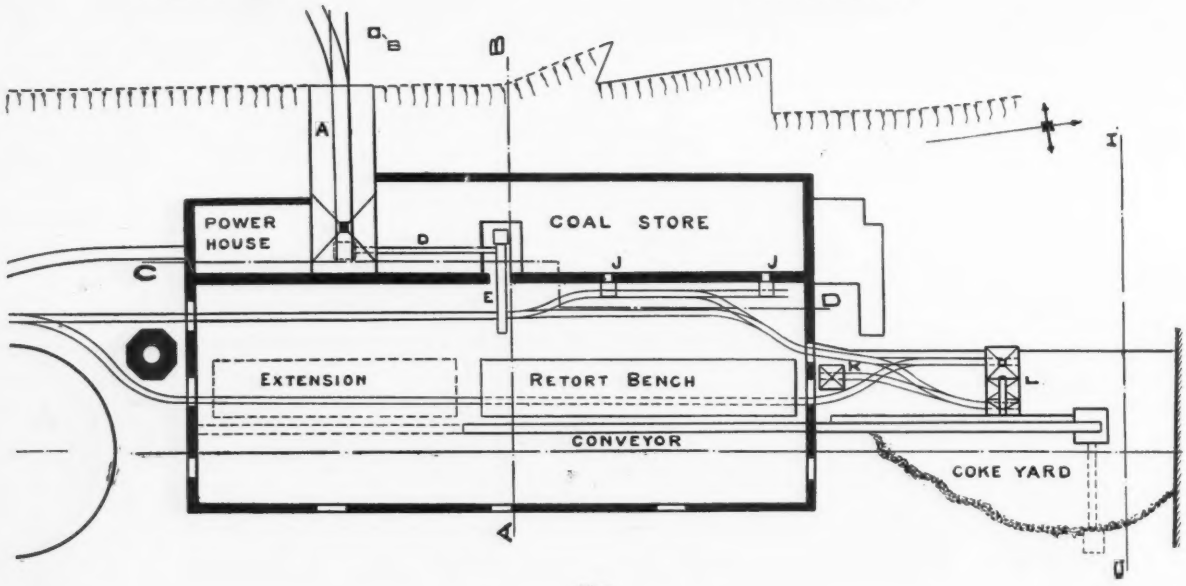
The structural work of the bench is now in the position when a thorough examination can be made of the manner in which it is being carried out. Wherever one looks—whether it be at the steel framing, the brickwork internal and external, the hoppers, &c.—it gives a good impression as to general substantiality, workmanship, and care on the part of the contractors. The contract was let, by the Dessau Company, conjointly to Messrs. Samuel Cutler



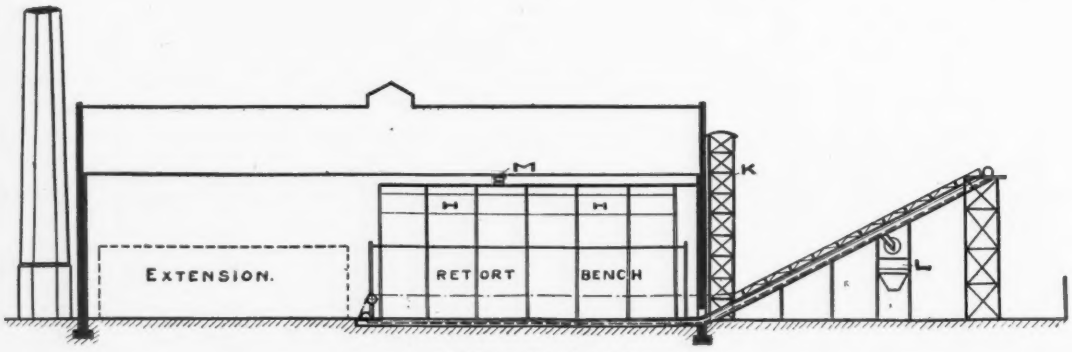
Section on Line A B.



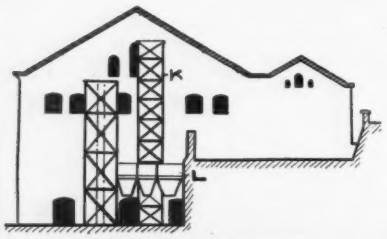
Section on Line C D.



Plan.

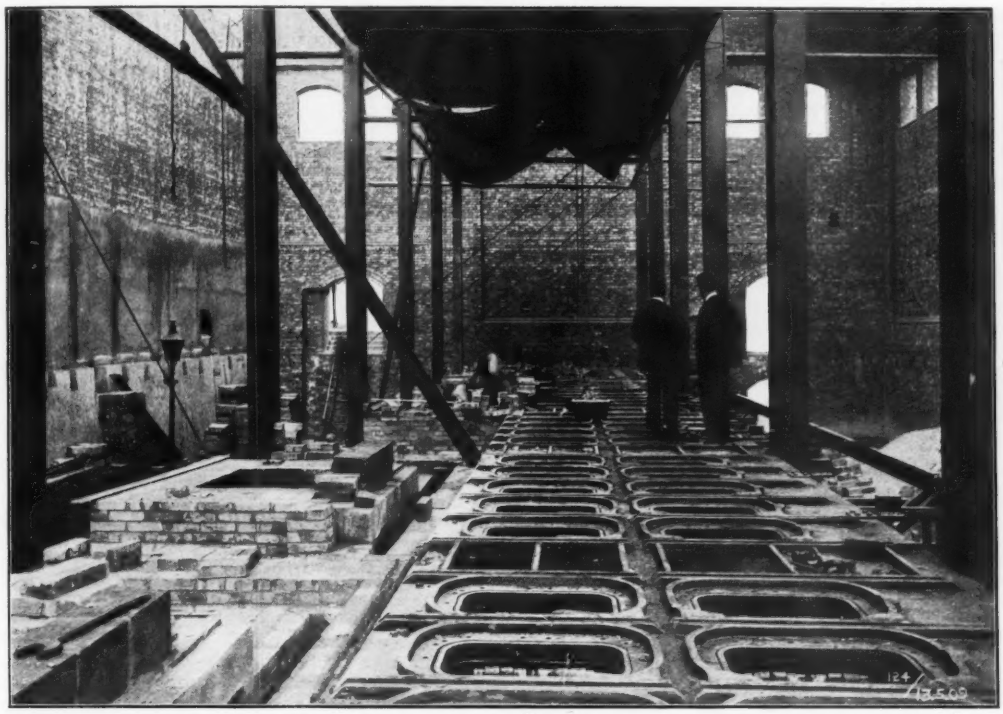


Section on the Line E F.



Section on Line G H.

A. Ferro-concrete coal bunker.
B. Capstan.
C. Coal-breaker.
D. Band conveyor.
E. Elevator.
F. Revolving screen.
G. Coal-hopper.
H. Continuous hopper,
J. Emergency shoots.
K. Coke-hoist.
L. Coke-hopper.
M. Waggon.



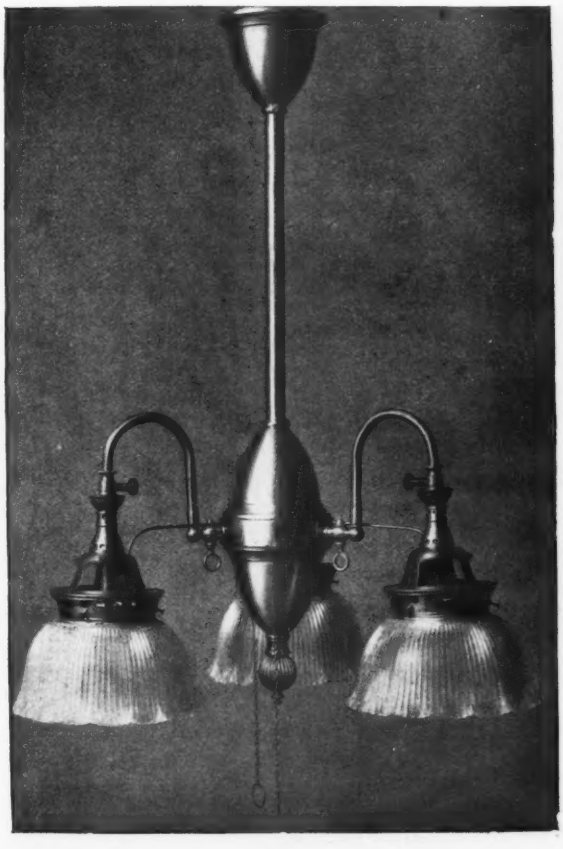
The Vertical Retort Bench under Construction at the Ayres Quay (Sunderland) Gas-Works.

and Sons, of Millwall, and Messrs. Graham, Morton, and Co., of Leeds—the former being responsible for the steelwork and fittings, the latter for the brickwork of the settings, elevators, conveyors, &c.; while Mr. Charles Hunt, of Westminster, is representing, in the capacity of Consulting Engineer, the owners of the system. It should be mentioned that it was stipulated by the Sunderland Gas Company that the whole of the material should be of British manufacture; but there was the reservation on the part of the Dessau Company that the lower parts of the retorts, and the fire-bricks used in the combustion chambers, should be made by the Stettiner Company, owing to their extended experience with the material required in these positions. But otherwise every part is British made by British labour. The whole of the brickwork of the settings will be finished early this month; so that the bench will be in readiness for use in the coming winter.

It may be of interest to note that the Vertical Gas-Retort Syndicate has been formed for the purpose of constructing retorts upon this system in Great Britain and the Colonies, having offices at No. 17, Victoria Street, S.W.

AN EFFECTIVE INVERTED GAS-FITTING.

In the course of a letter received last week from Mr. Bernard F. Browne, the Engineer of the Primitiva Gas and Electric Light Company of Buenos Ayres, he remarks: You will doubtless have noticed of late how great an advantage our electrical friends are taking from the employment of "Holophane" crystal goods in combination with the tungsten lamp. I have been looking in vain among the British gas-fittings manufacturers' catalogues for a cheap but elegant inverted fitting suitable alike for business houses and private dwellings. It has seemed to me that the advantage of the employment of "Holophane" globes in this connection has been somewhat overlooked. Thinking that such a combination might interest your readers, I am sending a photographic reproduction of a chain-pull combination which we have been employing very successfully in Buenos Ayres. It is of quite simple construction. The combination cock is hidden within the "spun" cups. The whole exterior is nickel-plated, including the burners, while the interior is made up with $\frac{3}{8}$-inch barrel. The glassware is "Holophane," made specially for use with the inverted gas-light.



Masonic.—Last Thursday the annual meeting of the Provincial Grand Lodge of Lincolnshire was held at Spilsby, when W. Bro. R. G. Shadbolt was appointed Provincial Junior Grand Warden of the Province by the Right Worshipful Provincial Grand Master, the Earl of Yarborough.

Reduction in Price by the South Metropolitan Gas Company.—In the "Journal" for the 13th of April, it was announced that the South Metropolitan Gas Company intended to reduce their price at Midsummer. At a meeting of the Board last Wednesday, it was decided that the amount of the reduction should be 1d. per 1000 cubic feet; bringing the price down to 2s. 2d.

Less Artificial Lighting.—Cincinnati, Ohio, has adopted the idea of setting the clock one hour ahead during the summer. The new ordinance becomes operative on May 1, 1910, and continues until Oct. 1, 1910. The measure is the first of its kind passed in the United States; and the National Daylight Association, who are fostering the plan, have made preparations to continue work on a larger scale.

LEEDS GAS COMMITTEE & VERTICAL RETORTS.

Report on the Sub-Committee's Visit to the Continent.

THE Leeds Gas Committee last Friday had before them the report of a Sub-Committee who, on Nov. 24 last, were appointed "to consider the question of adopting a system of vertical retorts, and, if thought necessary, to obtain information by visiting." The Sub-Committee consisted of the Chairman (Alderman Tetley), the Deputy-Chairman (Councillor Ratcliffe), and Councillors Brown, Hinchliffe, and Ambler. These gentlemen, together with the General Manager (Mr. R. H. Townsley) and Mr. W. B. Leech, of Messrs. Graham, Morton, and Co., visited gas-works at Berlin and Cologne; and the following is their report.

We left England on Thursday, April 15, and on the 16th we went to the head office of the Imperial Continental Gas Association, and after interviewing Herr Hayman, one of the Directors, and Herr Körting, the Chief Engineer, visited the Oberspree Gas-Works belonging to the Company.

OBERSPREE GAS-WORKS.

Here we were introduced to Herr Prinz, the Manager, who most courteously took us round and explained everything most carefully, and we gained much information.

There were four settings of verticals, twelve retorts, 16 ft. 5 in. high, in each, with the bottom mouthpieces 8 feet above the floor, worked by one man per shift. His duties were: To charge the retorts and producer; to draw the retorts and clinker the producer; and to attend to the coke-conveyor.

The production of these retorts is about 700,000 cubic feet per day. One other man per shift attends to the coal elevator and conveyor, and general preparation of the coal for the hoppers. This preparation is carried out by means of screens which separate the nuts from the fine coal.

The hoppers are divided into two parts—one for fine coal, the other for nuts. These two kinds fall into the retorts simultaneously in two columns, and the separation reduces the pressure in the retort very much, and greatly facilitates the escape of gas from the coal.

The charging of the retorts with coal from the divided hoppers and the generators with coke is effected from a platform level with the top of the retorts. The coke is discharged from the bottom of the retorts on the ground level; but the workman is not exposed to any great heat, for, as a rule, he stands about 10 feet away from the brickwork.

There was very little smoke either at the top or bottom of the retort when the coke was discharged and the coal run in; but this depends upon the kind of coal. What we saw in use here was 60 per cent. Hebburn Main and 40 per cent. Silesian.

In all cases before the coal is put in, about 35 lbs. of breeze or coke is dropped down to the bottom of the retort, to absorb such tar as does not pass over with the gas, and to reduce the pressure at the bottom of the retorts.

The retorts had been in work 800 days, and were in excellent condition. Scurfing is a short and simple operation, and is done every 35 days. The ascension pipes are seldom, if ever, stopped, and auguring is required only once a week.

The coke-conveyors were of the ordinary type; the quenching was done at the bottom of wooden shoots, which carried off all the steam.

HERR FELD'S PROCESS.

The same afternoon we had a long interview with Herr Feld about the new washer that he has invented. He claims that he can remove simultaneously both ammonia and sulphuretted hydrogen in equivalent amounts (without the use of sulphuric acid); part of the sulphur extracted being used in further extraction, and the rest sold.

His washer is extremely simple, requires very little power and attention, and relieves the purifiers of 70 per cent. of the work.

For full application he recommends:

First.—For tar-washer—One chamber, as hot as possible, to cool down to 160° or 120°, according to the nature of the tar, and one Pelouze washer.

Second.—One washer for the extraction of the ammonia and equivalent amount of sulphur.

Third and Fourth.—Two washers for the final extraction of sulphuretted hydrogen.

He was very confident of the efficacy of his process, and asked for a further interview after his return from Königsberg on Sunday. This we gave him, and had a most interesting talk on this and other subjects.

His reports from Königsberg confirm his previous statements. He left them with us, together with drawings of a complete plant for the extraction of sulphur and ammonia, and the necessary description thereof.

MARIENDORF WORKS.

These stand on a site of 350 acres, so are capable of vast extension. No. 1 house contains inclined retorts alone; No. 2 house, vertical—now in use; No. 3 house, verticals in process of erection.

To take the last first—This is designed throughout by Dr. Bueb, of the Stettiner Company, and seems likely to prove most substantial. The ironwork is a variety of combinations of standard sections, and looks very simple and efficient. The brickwork is of fire-bricks made near or at Stettin, and was being laid with the utmost care. We saw the secondary-air flues for the regenerators being laid. The joints were very exact, and the shape of the thin brick of a most useful type. We were told that the whole fire-clay work that had stood so well in the Oberspree works as well as here, was of the same material, and left nothing to be desired; and any builder of similar work would do well to make sure that English fire-clay is as durable as this undoubtedly is.

The house is to contain 28 beds of twelves, and is to produce 140,000 cubic metres or 4,900,000 cubic feet per day, and will be worked by eight men per shift. We noticed that the hydraulic main had condenser sumps attached, cooled by water-tubes, and the liquor goes back to the main.

In No. 2 house there were 168 verticals, fourteen furnaces, twelve retorts to each. Each division of seven furnaces was worked by two men per shift; and we were told that the actual time during which the men worked was 100 minutes per shift. As the time required for complete carbonization is twelve hours, no work is necessary during one of the eight-hour shifts; and the actual work is done in two shifts of eight hours, not in three of eight hours as with us.

The generators are of great depth, and consequently only require to be filled up with coke every twelve hours and to be clinkered every 48 hours.

The make was 330 cubic metres, or about 11,550 cubic feet per ton, before steaming began. Any water gas made then increases the make to about 13,000 cubic feet per ton.

The illuminating power tested by a Carpenter No. 2 "Metropolitan" burner averages 12·13 candles, with a calorific power of 537 B.Th.U.

Below the retorts there was but little steam when being discharged, and no smoke. Above there was a good deal of smoke—said to be due to the class of coal used; but there was more than at Oberspree.

To enable the manager to see how the coal distributed itself in falling into the retort, a wooden model (full size) had just been erected, with inspection doors to show the lie of the coal.

We only made a very cursory examination of the coal-conveying plant. The coal was brought from the wharf in large telpher skeps, holding about one ton each. There was a line direct from the wharf to the retort-house conveyors. On each side of this was a double line of a single rail; and on this pair of rails ran a bridge of wide span also carrying telpher skeps, but at right angles to the main one.

This combination made it possible not only to bring the coal from the wharf to the retort-house, but also to deposit it in the store yard or any given spot, and when required to bring it back to the main line and deliver for use at the retort-house. We thought the arrangement most admirably designed, and understood that the electric plant used to work the whole was only of 40 H.P.

In conjunction with the retorts a blue water-gas plant is used.

The purifier-house is a fine building. The material is used for a long time; one charge having been in use for 527 days.

A new house is being built on the overhead principle with plenty of room below to revivify the oxide.

The tar plant, cyanogen extractor, ammonia extractor, and cooling towers all seemed very up-to-date, and we were told left nothing to be desired in the way of efficiency.

We were told that it is necessary to meet by increased pressure two rushes of demand during the day—first, for cooking from 11.30 a.m. to 2 p.m.; second in the evening, both for lighting and cooking. Of the consumption, 50 per cent. is for cooking.

We took advantage of being in Berlin to see the high-pressure lighting in Belle Alliance Platz, and were much struck by its brilliance. The lamps contained burners in groups of three. They were not too close; they were placed alternately on each side of the roadway, which was about 66 feet wide, and gave a most admirable light all round.

VISIT TO COLOGNE.

We drove out to the gas-works at Ehrenfeld, and were courteously received by Herr Hass, the Manager, who took us over the works, which are gradually being equipped with vertical retorts to take the place of oval horizontals.

The vertical installation consists of 240 retorts, which are 13 feet high, instead of 16 ft. 5 in. as at Berlin.

These had worked 705 days continuously; and the condition of those we saw was extremely good. The charges are burnt off in twelve hours, the last two of which are devoted to the making of water gas.

The admission of steam is regulated so that the average gross calorific power of the mixed gas shall not be below 5000 calories per cubic metre (523 B.Th.U. per cubic foot).

The retorts are set ten in a setting, in two rows of five retorts. One producer serves a setting of ten retorts. Each setting has a separate hydraulic main, to which the gas passes by horizontal outlet pipes from the upper mouthpieces of the retorts. On the top of the bench is the charging stage, and at the back are the producer lids. A travelling hopper suspended from an overhead line passes along the lines of retort mouthpieces, and receives from overhead coal and coke storage chambers either small coal or coke. The hopper has a shoot with a spreader which drops into the mouth of the retort. The operations of charging and discharging are very rapidly and easily performed. The coke as it falls out of the

retort is received in a funnel-shaped travelling hopper, the open lower end of which stands over an opening in the conduit in the bottom of which is a conveying trough. One end of the conduit is connected with an upcast shaft, which draws off the steam generated by the quenching of the coke in the conveying trough, and carries it into the outer air. The arrangement works very nicely, and the atmospheric conditions in the retort-house were all that could be desired.

It is claimed that an additional 1·1 per cent. of ammonium sulphate is extracted from the liquor obtained from these retorts, and that as at Oberspree works the tar is purer and thinner.

The make is 90,000 cubic metres = 3,150,000 cubic feet,
to 100,000 cubic metres = 3,500,000 cubic feet per day.

These 240 retorts are charged and drawn by four men per shift per day. To attend to the 24 generators, six men per day are required. Three men per day do the cleaning up.

In addition, the conveyance and separating of coal requires six men per day, and coke handling six men per day—that is, coal handling, carbonizing, and coke handling require 33 men per day for 3½ million cubic feet of gas, but purifiers, &c., in addition to these.

The make of gas per ton, including water gas made by injecting steam into the retorts, is 13,000 cubic feet at least. The make of gas per ton without steam in inclined retorts, 10,600 cubic feet.

The coal store is a magnificent building, capable of holding 40,000 tons of coal—two months' supply, all brought in trucks by locomotive and tipped into the bunkers with taper bottoms to conveyors.

Westphalian coal is their chief material, and costs (say) 13s. 2d. per ton delivered into store. The railway passes close to the works, and carriage is therefore easy, and the great area of the site makes manipulation easy. This coal is highly inflammable, and must be stored with judgment.

The following statement shows the capacity and the results now being obtained at the three works:—

—	Oberspree.	Mariendorf.	Cologne.
Number of retorts.	16 ft. 5 in. retorts. 46	16 ft. 5 in. retorts. 168	13 ft. retorts. 240
Daily capacity . .	741,300 cu. ft.	2,472,000 cu. ft.	3,350,000 cu. ft.
Gas produced per ton of coal carbonized:			
Without steam	No trials made.	11,336 cu. ft.	11,654 cu. ft.
With steam .	13,094 cu. ft.	13,094 cu. ft.	13,420 cu. ft.
Gas produced per retort per day .	15,538 cu. ft.	15,538 cu. ft.	13,773 cu. ft.
Average heating value of gas (with steam) . . .	523·2 B.Th.U. per cu. ft.	537·7 B.Th.U. per cu. ft.	533·7 B.Th.U. per cu. ft.
Average illuminating power (with steam) . . .	11·5 candles.	12·5 candles.	12 candles.
Coke produced per cent. on coal carbonized . . .	70	70	70
Coke used for fuel per cent. on coal carbonized . .	15 to 16	15 to 16	15 3

The yield of gas, considering the low percentage of nitrogen present, amounting to something less than 2 per cent., is very satisfactory.

With regard to residuals, it is claimed that better results are obtained in every item over those of any system in use. The tar is thinner, containing very little naphthalene, and very little "free" carbon. The ammonia is not decomposed to the same extent, and the quantity is increased 25 to 30 per cent. The coke produced was much larger and harder than that obtained from similar coal in horizontal and inclined retorts, and the percentage of breeze was very small—amounting to only 1½ per cent. on the coal carbonized.

Other advantages of the system are as follows:—

The low labour charges; the cost of carbonizing wages being not more than 6d. per ton.

Increased make of gas per retort per man.

The low cost of repairs due to the increased life of the retorts, and the reduced wear and tear on tools.

Absence of trouble from stopped pipes and pitched-up hydraulics.

The members desire to record their thanks to the following gentlemen for the courteous manner in which they were received, and the valuable information obtained at each of the works visited: Herr Hayman, Director, Imperial Continental Gas Association, Berlin; Herr Körting, Chief Engineer, Imperial Continental Gas Association, Berlin; Herr Prinz, Manager, Oberspree Gas-Works, Berlin; Herr Hass, Manager, Ehrenfeld Gas-Works, Cologne.

Recommendation.

Following up the report of the deputation, the Gas Committee recommend—

That the Council authorize the erection of a suitable number of retorts on the vertical system, to enable the Committee to make a trial of them on a practical scale.

They are of opinion that this can be done efficiently and cheaply in either of the three works, either in a dismantled retort-house as at Meadow Lane, or to replace worn-out beds of horizontal retorts as at New Wortley or York Street.

They are not anxious at present to erect a large installation on any one system, as they are not without hope that one of those that work continuously may attain perfection, in which case they would desire permission of the Council to replace beds of horizontal retorts, as settings wear out, by the latest and simplest of these ingenious systems.

July 1, 1909. C. F. Tetley, Chairman.

Coalite Prospects.

In the "Journal" leader columns last week, some criticisms were offered on the then recently-issued circular to the shareholders of the two Coalite Companies. That some of the views then expressed are held in other quarters was clearly shown by comments in some of the London daily papers. For instance, the "Westminster Gazette" thus wrote: "It is doubtful if the shareholders of the two Coalite Companies, the parent and the subsidiary, will derive a great amount of satisfaction from the interim reports just issued. A certain amount of progress has been made; but the enterprise is still in the experimental stage, and shows no immediate prospect of emerging from that interesting but obviously not very profitable period. Shareholders will be struck with the omissions from the report quite as much as with the information afforded. Up to date [June 25], the Company have produced 14,194 tons of coalite, 383,725 gallons of tar, and 87,264,815 cubic feet of gas; but how the selling value of these products compares with the cost, is left to the imagination. It may, however, be noted that to produce 750 tons of coalite (the quantity which the Company hope to be turning out daily before the end of the year) involves the carbonization of 1250 tons of coal; and we fancy shareholders now learn for the first time that the chief profits are likely to be derived from the distillation of tar rather than from the sale of coalite. Whether the enterprise will eventually prove a commercial success, the future alone can decide; but the patience of the shareholders appears likely to be severely taxed before the dividend-paying stage is reached."

Underground Waters in Slate and Shale.

In the course of an article on this subject in "Engineering Record," Mr. F. G. Clapp says: "Notwithstanding the prevalent belief that slates and shales are not water-bearing, a great many wells have been drilled in them. In the carboniferous formations they are generally drilled to reach more porous beds below. In the Lorraine and other shale formations that contain very little water indeed, wells have been frequently drilled in a forlorn hope that a supply sufficient for domestic uses can be found, and sometimes they are successful. In slates which contain considerable water, however, this source of supply is not always appreciated. To this statement the State of Maine is an exception. In investigations of underground waters made by the writer in 1906 for the United States Geological Survey, the records of all wells in Southern Maine over 50 feet deep were compiled, so far as they could be obtained. In the investigation nearly 600 wells were found in the portion of Maine south of the 45th parallel of latitude. Of these there were 385, regarding which it was impossible to determine with certainty the type of rock. Out of this number, 222 were in slate, and 37 were in schist. As schist is in most cases a metamorphic form of slate, it is here given consideration. Thus in Southern Maine there are 259 wells, or 70 per cent. of those of which the type of rock is known, which are in slate or schist. In North-Eastern Maine, many hundreds of deep-drilled wells have been sunk in slate. . . . To summarize, we can say definitely that plenty of water of excellent quality is found in most types of metamorphic slate. This water may be found almost anywhere within the first 500 feet of the surface, and frequently deeper. The largest supplies are generally found within 200 or 300 feet; but plenty of water for the domestic use of an ordinary-sized family is generally found 50 or 100 feet from the surface. The deeper wells are recommended whenever practicable, as they are safer from chance pollution by surface-drainage. The composition of slate water is variable; but it is nearly always excellent for drinking, and, except in a few regions where there is considerable lime in the rock, it is not too hard for boilers, and causes very little scale."

In the course of an article on "Gas-Engines and Steam-Turbines" in the July number of "Cassier's Magazine," Mr. Percy R. Allen says it is an indisputable fact that from two to three times more power can be obtained by using gas directly in a gas-engine than by burning it under any form of steam-boiler Various authorities have conducted close experiments; and in all cases an economy of more than 2 to 1 has been realized. The writer himself had several years' experience, which enabled him to compare the consumption of gas when burned under boilers and when utilized in gas-engines. It has, he points out, become the fashion to say that capital charges are invariably the controlling factor in the cost of electricity; but where there is a high load-factor—as there must be when the gas derived from coke-ovens or blast-furnaces is utilized—the capital charges on a gas-driven plant compare by no means unfavourably with a steam-turbine plant.

THE PHAROS SYSTEM OF HIGH-PRESSURE GAS AND HIGH-PRESSURE AIR LIGHTING.

An article in the "Technische Beleuchtungs-Korrespondenz" points out that a few years ago there was no competition with the electric arc lamp where sources of light of great intensity were required. Welsbach lamps were at times grouped together several in one lantern, and a large number of various burners were constructed which gave a light of about 300 candles. There was, however, an increasing demand for lights of high power; and to meet this the Pharos light was introduced some years ago. Lighting effects may be obtained with it equal to those of modern electric arc lamps; while also, if desired, lights of lower intensity are just as well obtainable. With the upturned form of burner, the light emitted is projected upwards, and is therefore specially adapted for indirect illumination. A reflector is placed underneath the burner which reflects the light towards the ceiling, whence it is radiated back into the room. This form of lighting is specially applicable to business houses, technical schools, lecture rooms, schools, and draughtsmen's offices, as it has been found that the most delicate work can be carried out by indirect or semi-indirect lighting without the tiring of the eyes which ensues with some other methods of illumination.

An Example of Shop and Street Lighting.

Danish Gas Company's Show-Rooms, Copenhagen.

With the Pharos high-pressure gas system gas is supplied to the burners from the gas-mains through special apparatus at a pressure of 51 to 55 inches of water. In passing through the burners, the gas pulls in with itself a large quantity of air, by which a highly-intensified combustion in a small space occurs, and the mantle is raised to intense brilliancy. The high pressure air system, on the other hand, consists in taking air from the open and by means of the Pharos apparatus raising it to a pressure of 51 to 55 inches of water, at which pressure it is introduced through a special service to the burners which are fed with ordinary gas. The gas and air, therefore, mix first within the mixing-tube of each lamp, and there is no mixture of gas and air in the supply pipe. The question whether the high-pressure gas or the high-pressure air system should be adopted, depends solely on local conditions. If there are several consumers in one place requiring the Pharos light, the high-pressure gas system should be adopted. The gas supplied must, of course, be measured to each consumer; and, as it is measured in the compressed state, it is clear that a higher price per unit-volume must be charged for it. The high-pressure air system is, however, more suitable where it is desired to retain existing gas services, burners, cookers, stoves, &c., as then the high-pressure air supply need only be taken to the positions where the high-power lighting is required. Thus ordinary incandescent lighting can be used at the same time as the high-pressure air burners. It would be a work of supererogation to measure the volume of air, as that costs nothing. The cost of compression is also so small as to be practically negligible. The high-pressure gas system is used for street lighting even where the Pharos light is not made available for private consumers. It is also specially applicable to streets and places where there are no existing gas-mains.

According to the article from which we are quoting, the Pharos light shows an economy of 40 to 50 per cent. compared with ordinary incandescent gas lighting; of 40 to 60 per cent. compared with electric arc lighting; from 60 to 70 per cent. compared with electric metallic filament lamps; and from 80 to 90 per cent. compared with carbon filament lamps. The gas consumption per 1000 candle-hours is only 19·6 to 27·4 cubic feet. The lamps are easily attended to; and in the ordinary way they only require cleaning every two to three weeks. The mantles last from 150 to 200 hours. There are no chimneys. The maintenance charges are, therefore, considerably lower than with electric lighting. The light afforded by the Pharos system is said to be agreeable and not fatiguing; and the ultra-violet rays of the electric arc lamp do not preponderate with it.

Pharos Lamps in Centre of Street.

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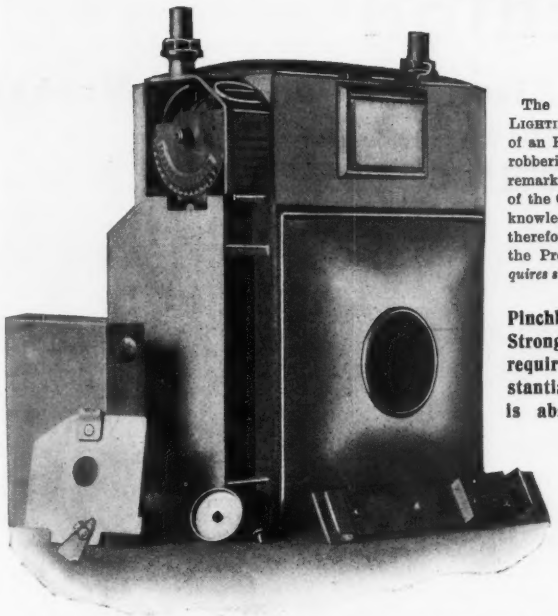

The "JOURNAL OF GAS LIGHTING," in the course of an Editorial Note anent robberies from Slot Meters, remarks: "The Flimsiness of the Coin Meter is the acknowledged tempting fault; therefore, the Coin Box of the Prepayment Meter *requires strengthening.*"

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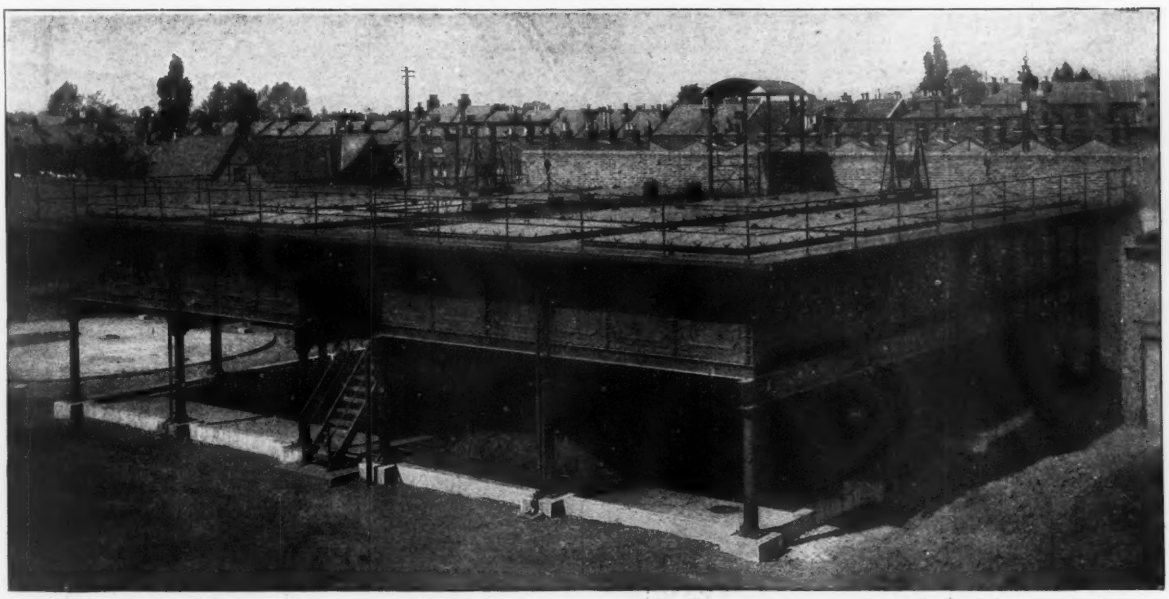

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REFLECTIONS ON CARBONIZATION.

By Thomas Settle.

History again repeated itself in the very able papers read by Dr. Lessing and Mr. J. Ferguson Bell, and subsequently discussed, at the recent meeting of the Institution of Gas Engineers. A large amount of time would be needed to find and give the honoured names of men who have on various occasions sounded warning notes such as those heard from Dr. Lessing and Dr. Colman. One might pause to refer to the early days—when, as some remember, there were in use the "Big Ben" and the "Little Ben" ovens, holding charges of 10 cwt. and 5 cwt. of coal respectively, and when, where retorts were used at all they were mostly small in section and of iron—and link them with the present.

In those olden days of low-temperature carbonizing, there was undoubtedly the usual fatal space for gas travel between the coal and the roof of the retort; and, it may be safely assumed that what happened then, in perhaps milder form, is happening now in a more violent form. Hence the greater necessity for a change. In those times there were no alarming records of any great disturbances by decomposition or polymerization of the gases attending carbonization, or any statistics showing the increase of naphthalene troubles, or the reduction of complaints, attended by the wail of what it cost to deal with either. For some years past we have records of papers and discussions condemning the long travel of gas in space and against high-temperature surfaces, with also full admission that such, even in this period, did play havoc with the heating and illuminating properties of the gas manufactured. Without at present dwelling on the special merits of any system of carbonizing, these warnings—then, since, and still—apparently rouse ambitions in inventors to produce something more nearly approaching perfection.

The history of gas manufacture, read and studied, proves still that "it is the longest hill that wears down the slipper most," and that the aim has always been to shorten the journey in the process of carbonizing coal. If any proof of this were necessary, we need only take the inventions of Brunton in 1828, Newton in 1851, Croll in 1857, Evans in 1861, Crampton in 1872, West in 1873, Dempster about 1880, and many others between these years and the present time. All these men were workers towards one end—viz., the continuous carbonization of coal with a view to its yielding the largest possible quantity of gas of the highest illuminating power. For the purpose of comparing theories with actual work, and tracing progress from more recent times to the present, it may be worth while to revive a few "old sayings," and put them with a few "new sayings," and from the progress in work covering a similar period we shall be able to see how much has been done, how much left undone, and how much has remained as it was in the beginning.

Mr. Norton H. Humphrys, in his book on "The Chemistry of Illuminating Gas," published in 1891, states (p. 212):

> It will be convenient to divide the effect of the heat as regards the production of gas into (1) the primary, as causing the evolution of volatile matter, and (2) the secondary, as relating to the effect exercised by the heat on the volatile matter after it is formed.

And later Mr. Humphrys says (p. 219):

> If we carbonize coal in thin layers, say one to two inches thick, at good heats, the yield of tar is practically *nil*.

Professor Vivian B. Lewes, in his lecture to the Irish Association of Gas Managers, in 1904, on "The Carbonization of Coal for the Production of Illuminating Gas," said:

> The ideal carbonization of coal would consist in subjecting every particle to a perfectly uniform temperature, so regulated that the decomposition of the hydrocarbons in the coal would yield hydrocarbon gases of the highest possible illuminating value. . . . Having gasified the hydrocarbons, the next essential is to remove them as rapidly as possible from the zone of heat, in order to prevent any secondary actions, which by decomposition or polymerization would break them up into less valuable heating or lighting gases. . . . It is at once evident that uniformity of action is really the keynote of success in any process of carbonization.

Professor Lewes, speaking of the Settle-Padfield process, also stated that the larger yield of gas and the higher sperm value were obtained at the expense of the tar, which in the process was "returned to the retort and again carbonized."

In the third volume of Groves and Thorp's Chemical Technology, Mr. Charles Hunt says (on p. 19):

> The different products obtained at higher temperatures are the result of the further decomposition of the primary products of the carbonization. As these gases pass through the surrounding mass of incandescent coke and along the heated upper portion of the retort, they decompose in various ways, producing other hydrocarbons and free hydrogen, and depositing carbon on the walls of the retort and in the pores of the coke.

And on p. 20:

> At the commencement of the carbonization of a charge of coal, when the exterior portion of the mass is undergoing decomposition, the hydrocarbons produced, not having to pass through or over incandescent coke, escape from the retort with comparatively little change. The illuminating power of the gas is high; and it contains but little of the more highly condensed hydrocarbons. As the carbonization progresses, however, the exterior portion of the mass becomes converted into coke, and its temperature rises and approximates to that of the retort itself; so that the gases produced in the interior of the mass have to pass through a gradually increasing thickness of incandescent coke. Consequently, the decomposition of the hydrocarbons becomes more and more complete, until finally little but hydrogen, with some methane, is produced. After the bulk of the gas has been driven off from the coal, it still continues to give off hydrogen for some time—adding to the volume of the gas produced, but lowering its illuminating power. Moreover, as the heat penetrates further and further towards the centre of the mass of coal, the amount undergoing decomposition at any one time continually decreases, so that the volume of gas given off gradually becomes less. This effect is increased by the low conducting power for heat of the surrounding coke.

Dr. Lessing states (see "Journal" for June 22, p. 841):

> By contact with the hot-coke, and by the surface and the radiant heat of the walls, it would suffer a degradation, with incidental deposition of carbon.

Dr. Colman, on p. 859 of the same issue, states:

> In carbonization, they had to consider two main points. In the first place, they had, in order to drive out from the coal the maximum quantity of the volatile matter, to heat the coal finally to the highest temperature they could obtain. On the other hand, the volatile products, which were first formed by the distillation of coal, themselves, under the further action of heat, underwent decomposition, which, up to a certain point, was favourable to the gas maker, but after that became disadvantageous. They wanted to hit the happy mean, whereby in carbonizing they could obtain the first of these desired ends—the raising of the coke finally to a very high temperature—without at the same time subjecting the volatile products to over-cracking or to too great an extent of decomposition.

Further on, towards the close of his remarks, Dr. Colman said:

> So it seemed to him they must aim at the cracking-up of the tars which were produced in the vertical retorts and the coke-ovens, just to the extent—they had to find out what it was—where the tar gave up its maximum quantity of carbon to the gas, without at the same time increasing the amount of free carbon and of naphthalene to an abnormal extent. This was the problem; and it would require a great deal of work before they could successfully solve it. But if they bore this in mind, and worked at it, no doubt eventually they would obtain the full benefit of the gas manufactured from the tar.

Mr. R. Forbes Carpenter, the Chief Inspector under the Alkali Act, in his last report, noticed in the "Journal" for the 15th ult., said (p. 708, col. 1):

> In the continuous vertical retort a zone of maximum and continuous heat exists perhaps at about three-fifths of the depth of the retort, measuring from the top.

The theories put forward as to what takes place inside a retort during the distillation of coal have long since been confirmed; and they are still with us in every-day work and practice. Whether these have moved forward, stood still, or gone backward, can well be gleaned from the tone of the papers and discussions so recently published.

The statement that was made eighteen years ago by Mr. N. H. Humphrys, he confirmed when he tested and reported upon the Settle-Padfield process at Exeter, where in some tests he obtained only 4¼ gallons of tar per ton of coal carbonized, in others had no tar at all to reckon with, as the figures of his tests show. The figures will be found in the "Journal," July 28, 1903, p. 235.

What Professor Lewes in 1904 told the Irish Association we are constantly repeating; and we have not altogether failed in approaching "uniformity of action," which he so aptly described as being really the "keynote of success in any process of carbonization." The earnest invitations by Dr. Colman to "hit the happy mean," and to "aim at the cracking-up of the tars," are surely partly answered in the results obtained by Professor Lewes, Mr. Humphrys, Mr. R. G. Shadbolt, and other experts, who tested for themselves the Settle-Padfield process at Exeter. These results have been published from time to time.

It may not be out of place here to draw attention again to the portion of Mr. Forbes Carpenter's report dealing with the "zone of maximum and continuous heat" at "about three-fifths of the depth of the retort," and what was later on stated in the letter which appeared under the heading of "Vertical Retorts" in the "Journal" for the 22nd ult.: "Ideal carbonization appears to remain in the zone-length of a retort fed from 2 to 3 feet from the bottom—occupied by hot coke—and on to a height of not more than 8 feet in all, giving also out of this a clearance of at least 1 foot above the charge at the top of the retort."

By a perusal of Professor Bunte's diagram, it is plain that there has been no approach to uniformity of production, either in the volume of gas obtained or in the illuminating power; proving the truth of Mr. Irving's remarks in the recent discussion that "it could never be a correct system of working to pass into a chamber 5 or 6 tons of coal, and there let it distil for 24 hours," and that "they must look to the continuous process as being most likely to produce the best and the most scientific results." Taking

the highest production of gas and illuminating power in Professor Bunte's diagram as being 100 per cent. in each case, we get—

	Make.		Candle Power.
1st hour	100 p. ct.	..	100·0 p. ct.
3rd ,, drops . . .	30 ,,	drops	51·5 ,,
6th ,, ,, . . .	37 ,,	,,	61·0 ,,
9th ,, } ,, . . . }	40 ,,	,,	58·4 ,,
12th ,, }			58·4 ,,
15th ,, . . .			67·5 ,,
18th ,, ,, . . .	52 ,,	,,	85·0 ,,
21st ,, ,, . . .	67 ,,	,,	94·0 ,,
24th ,, ,, . . .	92 ,,	,,	100·0 ,,

Taking Mr. Bell's figures of candle power as 19·9 the first hour, we get—

	Candle Power.
1st hour	100·0 p. ct.
4th ,, drops	26·0 ,,
8th ,, ,, ...	71·5 ,,

Taking the average production of gas as obtained hourly at four different works with horizontal retorts—

	Make.
1st hour	100·0 p. ct.
2nd ,, dropped	32·4 ,,
3rd ,, ,, ...	64·2 ,,
4th ,, ,, ...	86·8 ,,
5th ,, ,, ...	93·8 ,,
6th ,, ,, ...	96·3 ,,

Taking a single case where good large coal was used in horizontal retorts, we get—

	Make.		Candle Power.
1st hour	100·0 p. ct.	..	100·0 p. ct.
2nd ,, dropped . .	21·9 ,,	dropped	11·2 ,,
3rd ,, ,, . .	53·2 ,,	,,	22·3 ,,
4th ,, ,, . .	90·7 ,,	,,	33·4 ,,
5th ,, ,, . .	93·7 ,,	,,	62·0 ,,
6th ,, ,, . .	96·9 ,,	,,	77·8 ,,

Taking the averages of the tests already given, extending over three months, using slack coals with short-length carbonization and contact, in a vertical retort at Exeter, the results were as follows :—

	Make.		Candle Power.
1st hour	100·0 p. ct.	..	100 p. ct.
2nd ,, dropped . .	12·3 ,,	..	nil.
3rd ,, ,, . .	15·9 ,,	..	0·7 ,,
4th ,, ,, . .	18·6 ,,	..	0·7 ,,
5th ,, ,, . .	18·6 ,,	..	0·7 ,,
6th ,, ,, . .	28·0 ,,	..	13·9 ,,

At the sixth hour the feeding was stopped and the charges were burnt off for the purpose of weighing the coke and measuring the tar (if any) and liquor to record the tests.

With Dr. Colman's earnest words of encouragement, and with the results shown above, there is surely something stimulating to further efforts in a direction that will realize the desire of Professor Lewes for uniformity of action in carbonizing processes.

MIDLAND JUNIOR GAS ASSOCIATION.

Visit to Beckton.

What was in every respect a perfectly successful day was spent last Saturday by the large contingent of members of the Midland Junior Gas Engineering Association—they must have numbered close upon fifty—who paid a visit to London. The railway arrangements allowed of over twelve hours between the arrival at Paddington and the departure therefrom on the return home; but this proved none too long a time for those who desired to take part in all that had been arranged for them. The programme was such an attractive one that under any circumstances the visit could not have failed to be both a pleasant and instructive one; but the ideal weather conditions certainly added much to its enjoyment. As already explained, the visit originated in the fact that, when the Junior Associations met together at the Franco-British Exhibition last year, the Midland members could not arrive until late in the afternoon, when the gathering in the Congress Hall had been concluded; and Mr. W. J. Liberty, the President of the London and Southern District Junior Association promised that he would endeavour to arrange a day for them in London this year. The proposal was accepted, with Beckton as the objective; and Saturday's proceedings were the result.

When the visitors arrived at Paddington, they found awaiting them Mr. Liberty and Mr. H. Rothwell, a member of the London Junior Association Council; and without a moment's delay, two motor omnibuses, which had been chartered for the occasion, were boarded, and a start was made for the Beckton works of the Gaslight and Coke Company, permission to inspect which had been granted by Mr. D. Milne Watson, the General Manager. The run through the City enabled many of London's sights to be briefly but effectively noted; and after the somewhat lengthy railway journey, the drive in the open air proved doubly welcome. When, shortly before one o'clock, Beckton was reached, the travellers received a hearty welcome from the officials of the Company's staff who (by direction of the Chief Engineer, Mr. Thomas Goulden) were awaiting them; and they were also greeted by other members of the London Junior Association Council who had arranged to meet the party there.

The visitors were shortly afterwards made acquainted with the fact that the most hospitable preparations had been made for their reception; for they were invited into the offices, where they sat down to an excellent luncheon, to which ample justice was done. The chair was occupied by Mr. J. N. Reeson, the Resident Engineer; and it was noticed that in front of him were ranged several handsome silver cups, which had been won by the Company's Rifle Club at Beckton—an institution in which a great deal of interest is taken, and among whose members are to be found many excellent shots. After lunch, Mr. James Hewett, the President of the Midland Junior Association, proposed a hearty vote of thanks to Mr. Milne Watson, Mr. Goulden, and Mr. Reeson and his staff, for what they had done to make the visit to Beckton so successful, and also for the generous hospitality which had been extended to the party. The proposal was seconded by Mr. Harold E. Temple (the Hon. Secretary and Treasurer of the Midland Junior Association), supported by Mr. Liberty, representing the London contingent, and carried by acclamation. In reply, Mr. Reeson said that it was very kind of them to accord such a hearty vote of thanks, not only to the General Manager and the Chief Engineer, but also to himself and his staff, who would share his pleasure in showing the visitors the wonders of Beckton. It was a matter of great regret that the party had not been able to arrive earlier, because they had missed seeing in operation a part of the works on which the Company prided themselves very much indeed, He referred to the repair shops, which were on an extensive scale. Work in these, as it was Saturday, would have ceased when they reached them; and so they would have to be content with seeing what the shops were capable of doing. They were delighted at Beckton when any of their brethren in the profession favoured them with a visit; and they would endeavour in the future, as they had done in the past, to extend such hospitality as would make those who came feel that it would at any rate not be an unpleasant duty to have to come there again.

In the inspection of the works which took place both before and after lunch, the party were under the guidance of Messrs. J. L. Anderson, J. C. Johnson, A. H. Solomon, R. W. Hunter, and S. H. Wood. They did not, of course, go over the whole of the 263 acres which the works occupy, nor did they enter all fourteen retort-houses; but an itinerary had been sketched out which enabled an excellent idea to be gathered of the style of the plant and the nature of the operations that are carried out. The number of 10-feet retorts at Beckton is 8768, of which 1620 are hand-worked, and 7148 machine-worked. With the exception of two houses (where Arrol-Foulis chargers and the Hunter-Barnett pusher are employed) the machinery used is of the West type. At the present moment (which is, of course, the time of lightest consumption) there are five houses working – four with the West machines and one with the Arrol-Foulis. The productive power of the works is about 75 million cubic feet (13 million feet of carburetted water gas) per day; and the highest make in 1908 was 62 million cubic feet per day. The number of workmen employed in winter is upwards of 4000. Though, as stated, the area of the works themselves is 263 acres, the Company own about 1000 acres of land altogether at Beckton. The total holder capacity at these works is 19 million cubic feet. The gas is pumped from Beckton to London for storage and distribution through 48-inch high-pressure mains.

After inspecting one of the exhauster-houses, the party entered cars, and were drawn by locomotives up an incline and along a viaduct to No. 2 pier. Coal is stored under this viaduct; being conveyed from the piers in waggons fitted with bottom discharge doors, and deposited where required. It is then picked up again into trucks on the viaduct or the ground-level by steam-cranes with Hone's grabs. The storage capacity here is about 230,000 tons. On No. 2 pier there are twelve hydraulic cranes, worked at 750 lbs. pressure. Each crane carries a one-ton Hone grab, and is capable of slewing round to deposit coal into trucks. There is also fitted a luffing jib, by means of which the grab can be adjusted to any position in the ship's hold. About a minute is taken to complete the cycle of movement—lowering, raising, and depositing into truck. The average capacity is 50 tons per crane hourly; and the total capacity of the pier is about 12,000 tons per day. When filled, the trucks are passed over a weighbridge, of which there is one for each berth; the accuracy of these machines being checked weekly.

Re-entering the cars, the visitors proceeded along the viaduct leading to No. 1 pier. On the way was passed the hydraulic pumping-house supplying power for the two piers. This contains the following compound hydraulic pumping-engines: Two of 125 H.P., having 14-inch high-pressure and 24-inch low-pressure cylinders, 21 inches stroke, pumping 200 gallons per minute each. Three of 200 H.P., having 14-inch high-pressure and 14-inch and 24-inch low-pressure cylinders, pumping 320 gallons per minute each. The steam pressure in each case is 130 lbs., and the water pressure 750 lbs.

There were also passed retort-houses Nos. 13 and 14, which have a capacity of 7,500,000 cubic feet per day; and note was made of the system of viaducts connecting the piers with high-level railroads into the coal-stores of the retort-houses. Each retort-house has two low-level railroads for the removal of coke (one on either side of the retort-bench), and also two high-level roads over the coal-stores connected with the viaduct. Along these coal-waggons are run, each containing about 5 tons, and fitted with bottom discharge doors. In addition to the retort-house railroads, there is a viaduct running between the two main rows of houses, and another which joins this with No. 2 pier, running round the outer edge of the works. These are mainly used for coal storage. As a matter of fact, there are over 40 miles

of railway altogether on the works. All the main roads to the chemical works, the Great Eastern sidings, the viaducts, and the inclines are under control from signal-boxes—being worked on the block system. An instrument indicates the presence of a train on a section; and no other train is allowed on the section without warning by the signalman. The coke roads into the retort-houses are worked by hand signalling.

No. 1 pier is old, and is now seldom used for unloading coal, but largely for other materials, and for loading coke and chemical bye-products. It is double decked, with hydraulic rams and steam winches on the lower deck, and cranes and capstans on the upper one. The cranes carry skips holding about 12 cwt., which are filled by hand; and consequently the working is more expensive than at No. 2 pier.

Coming down the incline, the members saw the compressors which supply power for six retort-houses fitted with West's compressed air stoking machines. The large compressors have 15-inch steam cylinders and 9¾-inch and 14¼-inch air cylinders in tandem; the air being compressed in two stages. Two of these machines deliver 29,200 cubic feet per hour; a single West compressor, 16,000 feet per hour; and an Ingersoll compressor, 20,000 feet per hour. The total capacity of the retort-houses supplied by these compressors is about 25½ million cubic feet per day. Some time was spent walking through the large repairing shops, though everything there was at rest. An idea of the character of the work carried on may be gathered from the fact that there are 31 locomotives, two of which were built at Beckton. All repairs and renewals are undertaken in the shops; and rolling stock is built and repaired.

The retort-houses which had been set down for visiting were Nos. 8 and 13. The capacity of No. 8 is about 420 tons of coal a day, or 4½ million cubic feet of gas. There are thirty settings of ten retorts—600 mouthpieces, or 300 20-feet retorts. The retorts are 22 in. by 16 in., set in five tiers, and heated by regenerator furnaces. Six-hour charges are worked; and the make is 7500 cubic feet per mouthpiece per day. There are West compressed air machines; and the scoop enters the retort twice to deposit a charge of nearly 4 cwt. With these machines, retorts are drawn and charged at an average rate of about one per minute. There are four coal-breakers with elevators to hoppers, each driven by a 27 I.H.P. "National" gas-engine. The hoppers hold about 400 tons. There are towers for the automatic removal of tar from the hydraulic main. In connection with No. 13 house, there is storage for upwards of 6000 tons of coal; and here there are the Arrol-Foulis machines, and hydraulic pushers.

The visitors also inspected the twelve sets of Humphreys and Glasgow carburetted water-gas plant, which have a capacity of about 13 million cubic feet per day; and they saw a quantity of other plant—including purifiers the lids of which are lifted by means of hydraulic rams rising in the centre of the boxes.

When at last the exigencies of time compelled the party to make their way again to the works entrance, they remounted the motor omnibuses, and were conveyed back to Holborn Viaduct, where, under Mr. Liberty's guidance, they entered the City subways, some particulars of which were given in the "JOURNAL" for March 9 (p. 729). These subways are 11 ft. 6 in. high and 7 feet wide where they are under the footpath; while under the centre of the roadways they are 12 feet wide and 7 ft. 6 in. high, and semi-circular in shape. Their construction (to avoid opening up busy thoroughfares) was commenced in 1866; and they contain high and low pressure gas-mains, water and hydraulic supply mains, telegraph and telephone wires and cables, electric light cables, and pneumatic tubes. Mr. Liberty, in the course of the walk, clearly pointed out the simplicity of mainlaying by this method, and the ease with which connections can be taken to any house along the line of route.

The party came to the surface again just at the point where Fleet Street joins Ludgate Circus, and then stepped into Yexley's Restaurant, where they had tea together—being joined by some more friends, including Mrs. Liberty and other ladies. At the conclusion of this function, Mr. Hewett proposed a hearty vote of thanks to Mr. Liberty, and remarked that the London and Southern Junior Association were to be congratulated upon having such a President. He deserved the gratitude of the Midland Junior Association for the way in which he had carried out the arrangements for the visit; and, in addition to this, for having given them an interesting and instructive walk through the subways, which was doubtless a unique experience to most of them. Mr. Temple, in seconding, said that they had all of them much enjoyed the visit to Beckton; but perhaps they did not all recognize that it was through Mr. Liberty that they had been able to go there at all. He it was who obtained in the first place permission from Mr. Milne Watson to go to Beckton, and who made all arrangements. In addition to this, he had afforded them the great advantage of viewing distribution methods in the subways of the City, and had lucidly explained to them everything in connection therewith. The vote having been carried with acclamation, Mr. Liberty, in acknowledgment, said it was a source of great gratification to him to find himself in the position he did that day; and the little share he had taken in the day's arrangements had given him great pleasure—as it always did to do anything that brought him into touch with his *confrères* of the other Associations. He would willingly do for any of the other Associations what he had done that day. He thought it was Mr. Corbet Woodall who had said, "If you want to see Beckton properly, you will stay there three weeks;" and when they considered that they had only spent three hours there, they would agree that they had made the most of their time. Under the new scheme, no less than 11,000 men were now co-partners in the great undertaking of the Gaslight and Coke Company. He hoped this would not be the last time that the Midland and London Juniors would meet, and that those who had come up to town that day would take back the very hearty greetings of the London members to those who had been unfortunately prevented from joining the party. He trusted it would not be very long before the London Association paid a visit to Birmingham.

Before the party separated, Mr. J. Hinch, the Gaslight and Coke Company's Lighting Inspector of the City, said that it would give him great pleasure to show round during the evening any of the visitors who might desire to see the latest methods of gas lighting in London. A small band of enthusiasts availed themselves of this invitation; and they had no reason to regret their choice. After traversing the West End (by way of the Gaslight and Coke Company's Kensington show-rooms), a return was made to Kingsway and Fleet Street, where the high-pressure gas lighting was inspected; and then a visit was paid to the compressing station, and to the Temple for the purpose of examining the stair lighting carried out by the Gaslight and Coke Company, which drew forth many complimentary remarks.

ON VIEW IN THE DAVIS GAS-STOVE COMPANY'S SHOW-ROOMS.

SOME weeks ago, reference was made in the "JOURNAL" to an interesting object which had been seen in the Queen Victoria Street Show-Rooms of the Davis Gas-Stove Company, Limited. This was a cooker which was supplied by the firm to one of the London Gas Companies as long ago as 1878, and which had been returned to its makers after a life of utility extending over about thirty years. At the time it was not possible to give an illustration of this old cooker; but we are able to do so now, and would remark that comparison of it with the Company's latest pattern—the Davis 1909 screwless cooker—furnishes striking proof of the enormous advances that have been made during the past quarter-of-a-century in the matter of detail. The comparatively early position occupied by this cooker in the history of hiring-out of gas-stoves in London will be gathered from the fact that it

A Davis Gas-Cooker of the Seventies.

bears the South Metropolitan Company's label, and their number 1035; and yet, after all its years of active service, it is still in very good condition. Among the points that most attract attention in it are the wrought-iron ring burners under the hot-plate; and these three burners, it must be confessed, do show the signs of wear that would naturally be expected. The outer and inner casings of the stove are of plain sheet-iron, without packing; and the gas supply enters at the back of the oven. The runners on which the inside shelves rest are screwed on to the body of the stove; but the sides of the oven have no screws—being held together by corner plates. In fact, as was remarked when previously referring to the stove, a comparison of the old type with the latest "screwless" model turned out by the firm lends support to the contention that the manufacturers of the Davis gas-

stoves have—in the elimination of unnecessary screws—kept in view, right from the beginning, the question of maintenance.

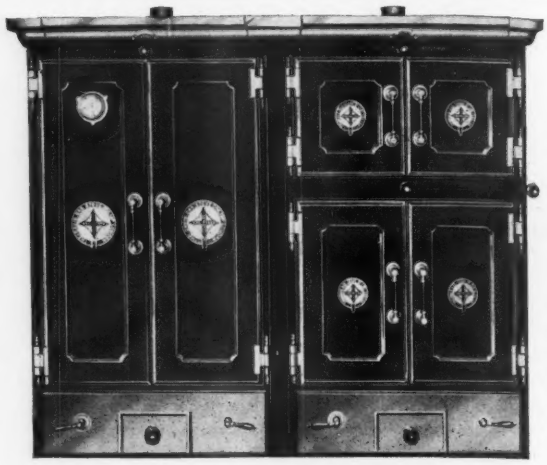
The object of the present article is, however, not so much to refer to the past as to draw attention to what is being done now in the way of designing appliances for the utilization of gas. In spite of the presence there of the afore-mentioned old cooker, it must not for a moment be imagined that the Davis Company's show-rooms are a museum. Nothing could be farther than this from their true designation; for they contain a varied assortment of the latest forms of apparatus for use in gas heating and cooking. Leaving out of question on this occasion the screwless cooker, which is already well known to gas engineers throughout the country, and the steamless radiator, which was brought so much to the front by the firm last season, there are many other things to be seen there which are deserving of some notice.

To turn at once from the oldest to the newest, the Company have of late been giving their attention to the perfecting of a fresh type of water-heater, which has been named the "New Davis" gas-heated circulator. This is being made in two sizes; and it has been designed with the object of obtaining the greatest amount of heating surface in the smallest possible cubical space. A size calculated to give an equivalent of two hot baths per hour, and suitable for connecting to a 20 or 30 gallon circulating tank, is only 15 inches high over all, 12½ inches wide, and 9 inches deep, with 1 inch flow and return pipes; and it contains 6 square feet of heating surface. The circulator is heated by a powerful triple cast-iron burner, which can be easily removed for cleaning purposes without in any way disturbing the gas connection. Over this burner is the patent heating chamber through which the water passes. This chamber is practically a tube made up of fins and rings alternately. The fins, or plates, are of mild steel, electrically welded; and they extend both inside and outside the tube. The great area of the outside portion—the plates are close together—is thus used for taking up heat, practically the whole of which is immediately conveyed to the water by means of the part of the plates which projects inside the tube. Outside the tube is a copper jacket, bolted on to a base plate; and the whole is then fitted into the outer case, which is of stout cast iron, of the highest quality used for hydraulic purposes. Between the copper and cast-iron casings is arranged a water-jacket, to prevent waste of heat by radiation. The cold water flows in at the top of one side, and fills the whole of the space between the two casings. Then it flows through an opening direct into the heating chamber; and as it passes through there, it is rapidly heated. The continuous circulation of the hot water, together with the rotary action set up by the formation of the tube, prevents furring-up. Any scale or deposit that may collect in the circulator can be easily removed; as in designing it particular attention has been paid to the point of accessibility for cleaning purposes, in order that the full efficiency may be maintained. The passages through which the flue gases pass can also be effectively cleaned; while great durability is claimed as a further feature in favour of the appliance, which can be had either with or without a thermostatic valve, for the purpose of automatically cutting down the gas consumption when the water reaches the desired temperature.

The "New Davis" Gas Heated Circulator.

Another novelty which the Company are manufacturing is Serne's patent hot-closet, which can be fitted to the top of any cooker, and has been designed with the intention of keeping warm plates, dishes, puddings, &c., by utilizing the waste heat from the oven and hot-plate burners, thereby effecting a great saving in gas as well as floor-space. The waste heat from the oven is conveyed to the hot-closet by means of a special pipe fixed at the back of the cooker, and is passed off through an outlet on the top of the hot-closet. When neither the hot-plate nor the oven is in use, and the hot-closet is required for warming purposes, it can be heated by a small atmospheric swing-burner fixed immediately under the bottom of the hot-closet. This burner can be thrown back when not in use. The door is swung at the top, and has a quadrant fitted at the side for support when open. This hot-closet is made in two stock sizes—24 inches and 30 inches wide—and five different varieties. The space between the bottom of the hot-closet and the hot-plate is 18 inches, which gives ample room for large utensils.

The Davis Gas-Stove Company have, of course, a very wide reputation for gas cooking appliances on the large scale, suitable for hotels, restaurants, business establishments, and public institutions; and there is a very large selection of these goods on view in their show-rooms. There are huge roasters, with the fronts, doors, base, and top frames of cast iron, and the outer casing



Large Roaster for Hotels, &c.

of extra-stout steel plates, with angle iron supports at the corners. The inner casings are enamelled steel plates; and there is a packing of patent non-conducting material. Inside are wrought-iron hanging runners for supporting the shelves, which may be easily detached for cleaning purposes; and these runners are arranged so that the shelves may be placed at any height, and withdrawn nearly their entire length without overbalancing. The burners are regulated to burn at low pressure without firing-back, and are protected by splash plates from falling fat; while each burner is under control of a separate tap. The doors and sides of the ovens are encased with polished oak or mahogany, iron tongued, and bound with polished brass bands; while pyrometers are fitted to indicate correctly the cooking heat.

Another appliance, which is found extremely useful in large establishments, is the firm's new and improved gas hot-closet. This has a body of extra strong cast iron, with wrought-iron sliding doors mounted on rollers. Inside there are three perforated shelves, and an atmospheric burner so arranged that it may be easily cleaned. The closets can be fitted with tiles or polished wood panels; and the carving table top can be arranged with either hinged or balanced covers.

Gas Hot-Closet.

There was also noticed, when passing through the show-room, an automatic hot-plate, fitted with a pilot-light. On placing a vessel over the burner, a knob is depressed; and this turns on the gas, which is lighted by the pilot jet. Inquiry elicited the fact that a good measure of popularity has been secured by this arrangement. Then there is the "Gascol" patent convertible gas and coal range, the oven of which can, when desired, be heated with gas and coal conjointly.

In bringing this notice to a close, perhaps, as indicating the tendency of the times, one other matter may be referred to, which was mentioned by Mr. Cyril G. Davis, the Managing-Director, and that is that the existing laboratory at Luton is making way for an altogether bigger place, which will be fitted with the latest scientific apparatus, so as to permit the Company to carry out exhaustive experiments both with high and low pressure gas apparatus.

GERMAN ASSOCIATION—ANNUAL MEETING.

Inaugural Address of Mr. E. Körting, the President.

(*Concluded from p.* 972.)

In his inaugural address (the first portion of which appeared in last week's "JOURNAL") Mr. Körting gave a history of the gas industry during the last fifty years—impressions and views of a technical man who was born and brought up on a gas-works, and has been active in the gas industry for twenty-eight years. After recording some of his earlier experiences, and referring to the work of his predecessors in connection with the gas supply of Berlin, he pointed out that the fundamental principle of their work was "far-reaching economy"—that an old installation was never replaced by a new one on the gas-works, but additions were always made wherever there was room for them. He then proceeded as follows.

It was the same with the distributing system in the town. Gas at that time was an illuminant *de luxe* in the fullest sense. The consumption per head of the population was very small, and the pipes only needed to have a very small diameter. Drory aimed with the greatest strictness at having no new main laid before it was absolutely necessary, and at carrying out no fresh connection without absolute certainty of its earning power. The net result was an extremely low installation capital and a very high net profit. Naturally, it must not be forgotten that coal and wages were very low at that time, and that coke, owing to the small extent of gas manufacture, was saleable at high prices. Thus things went on well for a good many decades. Then came the competition of petroleum on the one hand and of electric light on the other, and the great rise in wages; and the old profitable state of things came to an end.

A new era, with fresh views and methods of working, dawned; and who was it who stood on the threshold of this new period and served as our guide to the fresh goal? No other than the distinguished man and *savant* who, as our General Secretary, remains to-day at the head of our Association—viz., Geheimrat Dr. Hans Bunte. The first great work which he carried out, in conjunction with Dr. Schilling, was the scientific investigation of producer-gas firing. This marked the delivery from the earlier period. I can well remember the zeal with which the more advanced gas engineers flung themselves in this new direction. With what difficulties, however, they had to grapple before theory and practice were brought into unison! But a start had been made. Science had been placed at the head of German industry. What does this mean? We understand by Science, the systematic arrangement and co-ordination of that instinct of investigation and discovery which is the primæval dowry and the glory of the Aryan race. To be scientifically trained means not only to know the results of earlier inventions, but also the ways by which they have been achieved. To work scientifically means, on the basis of exhaustive study, to address methodical questions to Nature, and to understand the answers of Nature with open impartial senses, and to learn to act upon them with entire faith. To seek the truth and to give honour to the truth is the aim of Science. Our Association has adopted this aim in deciding, at the instance of Bunte, to found its Instructional and Experimental Gas-Works. I do not judge the value of this Institute of ours by the results which it achieves at the moment. These depend more or less on chance, or on the endowment of men directly interested in it. Rather do I value it for the spirit in which it was brought into being. The Experimental Gas-Works will seek the way to the truth, and must, like an impartial, incorruptible Court, be an umpire in the service of Truth. Truly, we ought to be proud that in our Association there was a majority for such a high ambition, and that the German gas-works, by rich material contributions, have shown their full agreement therewith.

Gentlemen, I cannot, unfortunately, fully portray to you the great advances for which our industry has to thank Science. It must suffice to quote a few great names. Without Auer von Welsbach gas would to-day have completely vanished as a means of lighting. The struggle with our old enemy naphthalene also distinguishes characteristically the rule-of-thumb and the scientific ways of working. For years and years the means of avoiding naphthalene stoppages was a standing heading in the technical literature and a constantly recurring theme for papers at meetings. What endless time and trouble have the so-called practical men spent on the naphthalene question, but in vain! They did not understand how to draw correct conclusions from properly arranged investigations. Then came Dr. Bueb (a pupil of Bunte) who used the oil in which naphthalene best dissolves in a special standard washer. Thus the naphthalene question was solved; and, still more, Bueb taught us, by most meritorious researches with vertical retorts, how, even in carbonization, the formation of naphthalene can be avoided. Not only this, but his scientific review of the results of carbonization in vertical retorts has overthrown the views of several generations of gas men, and at one stroke has established as chemically and economically correct carbonization in completely filled retorts. Further proofs of the stimulating influence of Science on our industry are not needed. We may hope that these influences will continue to gain in strength, as the number of our technical men having a complete college training is constantly increasing; and—*noblesse oblige*—I expect our young men to put us (their predecessors) to shame by the capableness of their performances.

But Science does not do everything. There are many other important factors co-operating in the transformation of conditions, and, in particular, competition. The gas industry, which had for so many years all the advantages and disadvantages of a monopoly, found itself suddenly exposed on two sides to a heavy attack. Electricity pressed it on the one hand, and extremely cheap mineral oil on the other. For a time it appeared as though the *rôle* of gas as a means of lighting was played out. Then came active men who set themselves to conquer a new field of activity for gas as a valuable heating agent. The Dessau central workshop was started; and in Hanover my Company allowed Richard Goehde to sound his battle-cry "Cook with Gas," which later went from Berlin into all Germany. The ice was thereby broken. The superior gas manager of the good old time remained quietly at home and let the public ask him for a gas supply; whereas the gas manager of to-day must use all the methods of the modern business man in order to allure customers. Among these methods may be mentioned shop exhibits, advertisement by word and pen, letting apparatus on hire, and payment by instalments. Hand in hand with this revolution, there has been a complete change in the customers. The none too numerous large and rich consumers went over to electric lighting. Gas, however, by way of the kitchen, secured the whole middle position, and so entered again by the back door into the sphere of opulence. And not content with the middle position, we are now busy, with the help of automatic meters which had first been used in England, in gaining the lower strata of the population as gas consumers. In other words, gas-works now year by year expend very great sums on connecting to the distributing system, without charge, all houses in which there is no gas; and shortly this object will be completely attained. Truly that is a revolution in one or two decades such as would have scarcely seemed possible. This powerful movement in favour of new gas connections was supported by the striking development of commerce and industry. It was not only that there was more money constantly available and more people continually coming into a position where they could frequently spend a copper on gas. No, there were also great forces acting for the improvement of lamps and heating apparatus, and for the introduction of new types in the market. Thanks to the striking elaboration and introduction of the inverted incandescent light and of high-pressure gas lighting, it was possible for gas lighting to attain complete economical superiority in the contest with electricity. Then industrial works came more and more into the foreground as large consumers. To-day there are works which consume 35 to 70 million cubic feet of gas per annum for heating.

While the rise and improvement of industry in Germany have thus proved powerful incentives to gas consumption, they have at the same time exerted no less influence on the modification of our methods of gas manufacture. The profitableness and the security of gas supply were threatened by the rise of wages and the unreasonableness of the workmen. Then great engineering and fire-brick works, with the help of gas engineers, produced that large number of mechanical appliances which render us completely independent of our workmen. Coal is unloaded, stored, and taken from the store mechanically. In the retort-house drawing and charging machines, inclined retorts, carbonizing chambers, and vertical retorts have shown most successful development. For coke, conveying chains and reservoirs for the night production have reduced hand labour to a minimum. By dividing the stream of gas and by adding air, labour in the purifying house has become almost unnecessary. Following the example of England, where years ago Mr. Corbet Woodall constructed the first gigantic gasholder, German gasholder construction has attempted the greatest of tasks with success. For the distribution of gas, fans, high-pressure mains, and governor stations at suitable points of the distributing system, have been adopted. In other words, our gas-works have made full use of the resources of the constructing and civil engineer, and have grown according to the need for gas manufacture and the handling of materials on a large scale into superior and well-arranged workshops. The advance which has to be chronicled in regard to the fundamental operation of the gas industry—viz., carbonization—is somewhat more modest. The methods and results have not considerably altered in the chemical sense for many years notwithstanding Dr. Bueb; and, apart from carburetted water gas, which cannot be used unless the price of oil is low, no economically possible way has been found of producing a heating gas of high value apart from dry distillation.

We have so far endeavoured to get a more or less clear picture of the difference between the past and the present. It appears to me, however, to be not less interesting to follow statistically and critically the gradual development of our industry. A large number of gas-works have been good enough to place data at my disposal, so that I have been able to draw up diagrams which are now presented to you. The data refer to the years 1858, 1868, 1878, 1888, 1898, and 1908. Thus the development may be followed at intervals of ten years. In calculating the results, the different sizes of the various towns have not been regarded. The figures refer to the average output of forty works.

The first diagram, fig. 1, shows the advance in the retort-house. The make of gas per ton of coal has risen on the average from 8074 cubic feet in the year 1858 to 10,765 cubic feet in the year

1908. But these figures do not fully represent what has been achieved by last year. We can to-day, with the assistance of blue water gas, produce 12,560 cubic feet, and in the vertical retort 12,920 to 13,275 cubic feet of gas of 530 B.Th.U. calorific power. On the average, an advance of about 60 per cent. has been made since 1858. The make per retort per diem has risen on the average from 3285 to 9430 cubic feet, or by 200 to 300 per cent. This average, however, does not correspond to the fullest extent with the present position of the industry; for inclined and vertical retorts yield up to 17,660 cubic feet, and chamber carbonizers up to 63,600 cubic feet, of gas per diem.

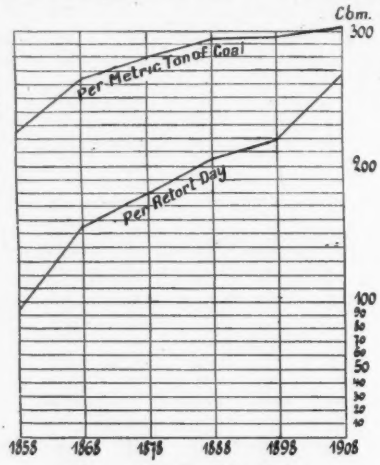


Fig. 1.—Average Make of Gas.

[1 Cb. m. = 35·316 cubic feet. 1 metric ton = 0·984 English ton.]

Diagram No. 2 refers to our most important bye-product—viz., coke—and the different types of setting have been taken as the basis of a comparison, instead of average figures. The topmost curve shows clearly how, as a result of the increasing yield of gas per ton of coal, the production of coke per thousand cubic feet of gas has been falling off—from 145 to 119 lbs. In regard to the consumption of fuel, it attained its minimum with producer settings worked by hand. The rapid increase in machinery has caused it to rise continuously. Thus we have to-day left over for sale only 83 lbs. of coke per 1000 cubic feet of gas, against 91 lbs. at the time of the direct-fired settings, and 107 lbs. at the time of producer settings. This development, however, has served its turn in regard to the price of coke. With reference to the workmen, I cannot give averages, but only the figures for my own Association in Berlin, which are shown in fig. 3. The curves of this table serve to control the performances of the engineers. It will be seen how between the years 1858 and 1888 the work done per head inside the retort-house has been gradually increased to double. Then between 1888 and 1898, on the crest of the new era, there is a small set-back. In the last ten years, however, the work done has again nearly doubled, so that in the course of fifty years only a quarter of the number of hands is required for the same make of gas. Almost exactly the same curve applies to mechanics; and with the immense increase in the use of machinery, it is very gratifying to find that only one-quarter of the mechanics formerly required are now necessary. The outside hands, as against those employed inside the gas-works, however, cannot be expected to show a great increase in work per head. In this case the curve indicates the intensity of the Trade Union movement. It is comparatively high in 1858; then falls in 1868-78, to a minimum in 1888; and in 1898 and 1908 returns nearly to its original figure. While, however, without lamplighters, in 1858, there was one man out of doors to five men on the works, we have now four out of doors against five inside.

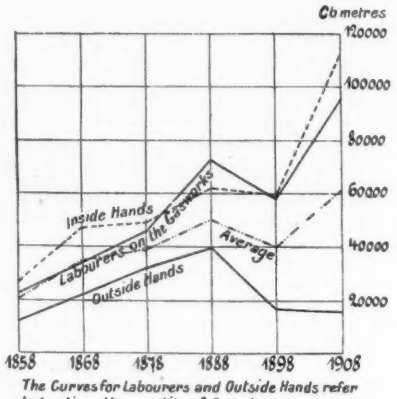


Fig. 3.—Make of Gas per Man per Annum.

[1 Cb. metre = 35·316 cubic feet.]

The full significance of the labour conditions is, however, first realized on comparing the increases in wages which are shown in fig. 4. We have here the interesting result that the average curves are nearly parallel for all classes of labour. The work done per head has about trebled in fifty years. The wages, however, for stokers, for instance, have risen from 2s. to 5s. 9d. per diem. The position of the gas industry therefore is that, economically, not the smallest advance has been made for fifty years. On the other hand, we have been compelled to erect large and costly installations and machinery only to maintain ourselves at the same position.

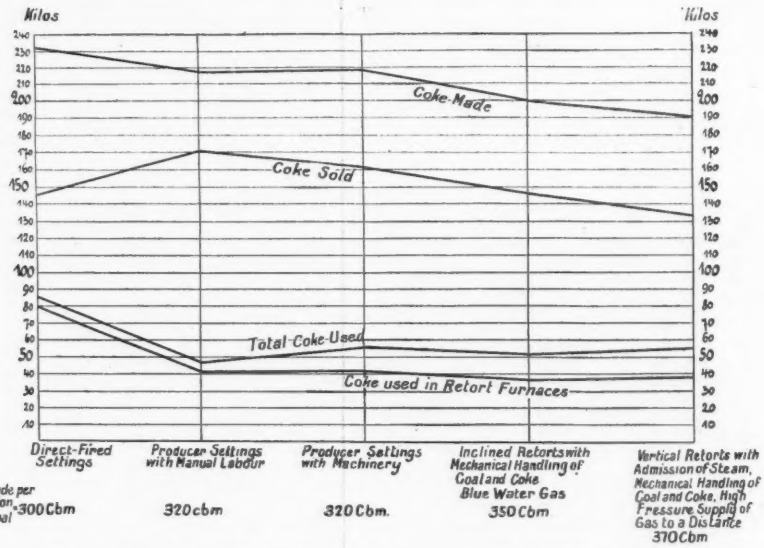

Kilos
Kilos
Coke Made
Coke Sold
Total Coke Used
Coke used in Retort Furnaces
Direct-Fired Settings
Producer Settings with Manual Labour
Producer Settings with Machinery
Inclined Retorts with Mechanical Handling of Coal and Coke Blue Water Gas
Vertical Retorts with Admission of Steam, Mechanical Handling of Coal and Coke, High Pressure Supply of Gas to a Distance
Gas Made per Metric Ton of Coal
300 Cbm
320 cbm
320 Cbm.
350 Cbm
370 Cbm

Fig. 2.—Coke Made, Sold, and Used on Works, per 100 Cubic Metres of Gas.

[1 Cb. m. = 35·316 cubic feet. 1 kilo. = 2·2 lbs. 1 kilo. per 100 cubic metres = 0·624 lb. per 1000 cubic feet.]

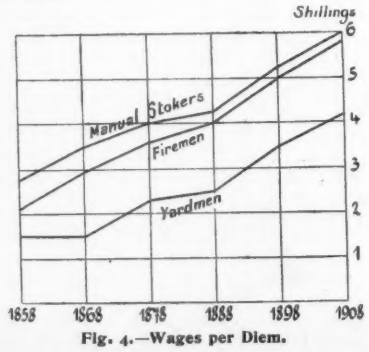


Fig. 4.—Wages per Diem.

The diagram fig. 5, which shows the prices of coal over three

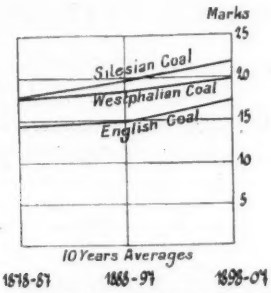


Fig. 5.—Price of Coal per Metric Ton in Berlin.

[1 mark per metric ton = 12·2d. per English ton.]

decades, affords us still less ground for congratulation. The figures given refer only to Berlin, but must likewise be of fairly general applicability. In the decade 1878-88, Silesian coal cost in Berlin about 17s. per (metric) ton. Ten years later it cost 19s. per ton, and in the last decade, on the average, 22s. That is a rather discouraging state of things. Fig. 6, which shows the net

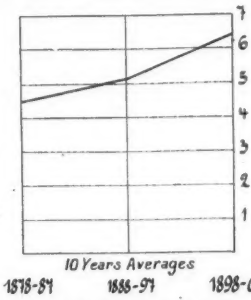


Fig. 6.—Cost of Gas, including Capital Charges, at the Berlin Municipal Gas-Works—Pfennigs per Cubic Metre.

[1 pf. per cubic metre = 3·4d. per 1000 cubic feet.]

cost of gas in Berlin, should be regarded in conjunction with fig. 5. It cannot be merely chance that the cost of gas has moved upwards almost in the same proportion as the cost of coal. Gas in Berlin cost, between 1878-88, 1s. 3¼d. per 1000 cubic feet; between 1888-98, 1s. 6d.; and in the last decade, 1s. 9¼d. In other words, in a quarter of a century, the cost has increased by 40 per cent. Thus all our technical advances are of very little importance compared with the inexorable increase in the price of raw materials, and have only had the result that we are not yet much worse off. In the works under me, I have the whole scale of development before my eyes. Among them is one small gas-works in course of reconstruction which has been maintained just as it was thirty years ago. I can assure you that in this instance the total advance in this period can be placed at 5·1d. per 1000 cubic feet. If the Municipal gas-works had remained stationary at the position of 1878, gas would to-day cost about 2s. 3d. per 1000 cubic feet, or about 80 per cent. more than at that time. We gas men have, therefore, with toil and trouble recovered half the lost ground. Gentlemen, that is a serious, even a very serious, position by which our whole activity is limited to order.

A much more pleasing picture is afforded when we regard the use and distribution of gas instead of its manufacture. Gas as a distributor of light has shown itself capable of development to a surprising extent. For instance, it may be seen from the curves

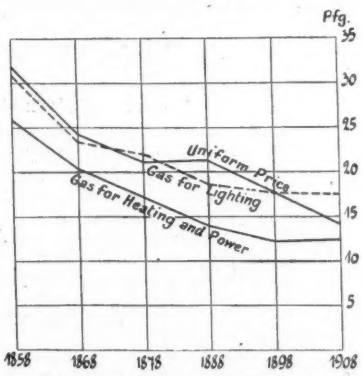


Fig. 7.—Price of Gas to Private Consumers in Forty Towns—Pfennigs per Cubic Metre.

[1 pf. per cubic metre = 3·4d. per 1000 cubic feet.]

that the cost of a given number of candle-hours is less than one-tenth what it was fifty years ago; and that, correspondingly, the candles obtainable for a given expenditure have been increased more than ten-fold. Even within the last ten years, the light obtainable through gas for a given expenditure has doubled. This enormous gain has fallen into the consumer's lap without trouble to him. If, therefore, gas-works, in order to meet the high price of coal, have of late years obtained rather more gas from a ton of coal and have lowered the calorific power by a small percentage, that is as nothing relatively to the advances in the art of lighting, and is not to be begrudged them.

The diagram, fig. 7, shows clearly the alterations in the price of gas, which has fallen quite considerably. It might be wished, however, that the curve were still steeper. It is interesting that more than ten years ago the dual system of prices was almost exclusively in vogue, and that it is in the last decade that a large number of gas-works have again adopted a uniform price for gas.

The effect of the price of gas and of the advances in the art of lighting has been to develop the output of gas as shown in diagrams 8 and 9. It is especially interesting to notice in

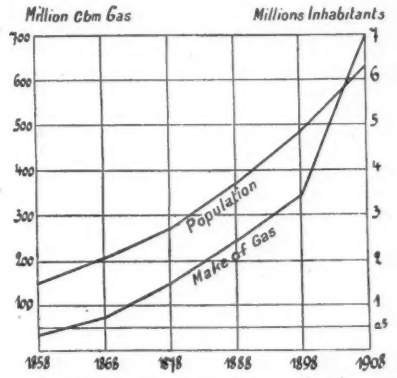


Fig. 8.—Make of Gas and Population for Forty Towns.

[One million cubic metres = 35,316,000 cubic feet.]

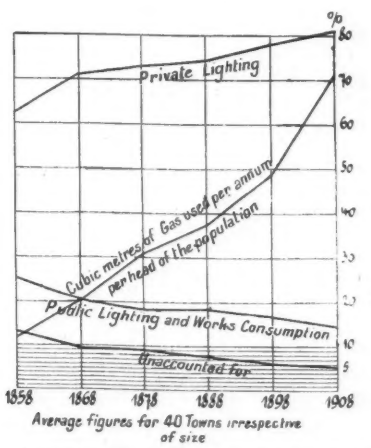


Fig. 9.—Proportions of Gas Used for Different Purposes in Percentages of the Total Consumption.

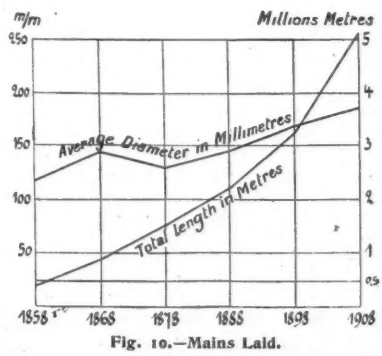


Fig. 10.—Mains Laid.

[25·4 millimetres = 1 inch. One million metres = 623 miles.]

diagram 8 how the gas production has risen more rapidly than the population. Fig. 9 shows how the gas consumed is employed. The percentage for public lighting and of unaccounted-for gas has gradually fallen from decade to decade. The proportion of the total output of gas which is taken by private consumers has risen gradually, so that it is now between 80 and 90 per cent. It is very satisfactory also to notice that the annual amount of gas consumed per head of the population has risen—as is to be seen from the middle steep curve in fig. 9. The next diagram, fig. 10, shows the growth in the length and the diameter of the gas-mains laid.

Gentlemen, you have accomplished in a few minutes a mighty

piece of work. You have set yourselves back in the good old time, and have seen clearly that this Paradise of engineers and of shareholders was bound to be destroyed. You have seen the development which our industry has rapidly undergone in the hard struggle for its existence. Let us stop for a moment's breath and glance backwards as well as forwards on our position. We can say with pride that our industry rests to-day on the broadest and the soundest basis. Gas for heating cannot be displaced for many purposes, and gas for lighting has at the same time developed like the electric light, so that both methods of using gas should find in the household and in industry an extension of use which was unforeseen earlier. On the other hand, we have not hitherto succeeded in reducing the cost of manufacturing gas. Rather the profitableness of the gas industry has diminished. Gas-works and the operations outside the works have become so much more costly and complex, and gas supply takes more and more the character of a modern highly developed branch of industry. If we would therefore maintain the high position of our industry and at the same time continue to develop it, many serious questions crop up which require the best men for their solution. It is, therefore, gratifying to note that a large number of towns have at the present time nominated technical men on their gas and water boards of administration. We could wish that this expansion should become the rule in future, and not only that, but we ought also to set ourselves to attract vigorous and good recruits. Old gentlemen have assured me that the intellectual and social level of our gas engineers has risen on the average from year to year. Diligent, well-directed work from a sense of duty and pleasure is in fact not the exception but the rule in Germany; but, nevertheless, we must not be oblivious. Private industry takes a large part of the active and capable technical men, and in this way draws to itself the greatest proportion of the best intelligence. Who shall prevent us doing the same?

We require relatively to our business an extremely small number of engineers. Let us pay them well, and thereby be enabled to make the highest claims on them and secure the best among good candidates. Let us not forget also that of the many millions which our industry has to spend yearly on orders, nothing is easier than to make an illegitimate profit, and that it must only be expected of a well-paid officer that he will withstand the temptation. If the town possesses a works, it must, if it is to stand at a high level, be worked in a business-like manner and not bureaucratically. The salaries and the freedom of officials must as far as possible be those which prevail in the open industrial market, and the business methods, the selling and buying prices, must be made independent of the councillors assembled round the green table. These are special requirements which, however, present great difficulties of organization. This knowledge is every day coming home to more and more people; and hence it comes about that the eagerness of towns to take over gas-works into their own management is not so great as it was at one time, and that many gas supply contracts are being renewed with private companies. It would, I think, be a great loss for our industry if the spirit of private enterprise were quite excluded from it. The chief reproach which was formerly levelled against gas companies—viz., that they made exorbitant profits—no longer applies to them. If, therefore, companies are struggling for existence or attempting to set up a good business, it is incumbent on them to calculate closely and to use the best technical and commercial methods. They are by their position predestined to take "Forward!" as their motto, and so do a not inconsiderable service to the common weal.

The immense extension of our industry has not taken place without leaving its traces on us technical men. We have been forced to work hard, and I think each of us has worked with might and main. But I cannot help having the impression that our working methods have not yet rightly adapted themselves to the scale of our operations. Those in charge of our large works are not overworked as an exception but as a rule, and where that is the case fault must be found with the organization. The manager is encumbered with too many details. My distinguished predecessor, the eminent Edward Drory, has gone to his grave before my eyes because he felt himself responsible for every detail. How can we help ourselves? I am of opinion that by well-directed decentralization it will be possible for a large number of men to work together and to share the responsibility. When that state of affairs arrives, the young technical man will be required to take pleasure in his work and have intelligence and business ability. The chief will then direct his energies more and more to superintending the quality of the work. He must stimulate the large number of coadjutators and get them to work together for a common goal. But the manager would economize time, and his brain would again on occasion turn to something else besides gas, gas, and always gas!

In conclusion, gentlemen, I wish hearty prosperity to the gas industry. May its curve of development in the next fifty years be as sharply directed upwards as previously, and may the technical men who fifty years hence will be responsible for the gas industry have reason to look back on us with benevolent smiles as engineers who were energetic in their work, and as men who, besides their work, had still plenty of time for humanity and art, for Church and State. Gentlemen, once more good luck to us and our successors.

GERMAN GAS AND WATER ASSOCIATION.

Reports of the Technical Committees.

(*Continued from p. 971.*)

III.—Gas-Meter Committee.

The Committee report that they have been unable to get on as intended with one subject of their labours owing to unexpected delay in obtaining the fabric for the preparation of the artificial membrane for use in the experimental meters. Careful experiments disclosed a trustworthy method for impregnating the raw fabric. Details have been given in previous reports. But this is not the case with the fabric for the new membrane. The Committee considered that they should have some sort of guarantee that the fabric was of a kind and quality suited for the preparation of membrane. They did not, therefore, choose blindly from staple commercial wares, but went back for samples to pieces of fabric which had remained good after more than twenty years' use in meters of System V. Examination showed that this membrane was in part perfectly gas-tight, and only in places somewhat permeable owing less to the fabric than to its preparation. There was great trouble in finding a weaving mill to manufacture the fabrics according to sample, owing partly to no long contract being in question. After protracted negotiations, the efforts made were successful; and there was placed at the service of the works entrusted with the manufacture of the trial gas-meters for the durability tests fabrics which agreed closely with the samples, and which were suitable for the preparation of a durable membrane. The agreement was established by a recognized testing office, which makes a speciality of the testing of fabrics, and the opinion of which can be accepted as of weight. The Committee regret the delay which has thus arisen in carrying out their design, and ask the forbearance of those works which expressed themselves ready to undertake durability trials, in regard to the dry meters for the purpose not having yet been delivered to them.

The new weights and measures law was adopted by the Reichstag without the provision that gas-meters in use must be reproved from time to time. It allows at the same time greater freedom as to the float valve in wet meters. In view of the difficulties resulting from these valves as previously constructed, the Committee have considered their abolition in favour of devices by which the water-level can at any time be seen from outside. These devices, however, did not fulfil the requirements of the Standards' Commissioners. The Committee had deferred the question of a reduction in the fees for stamping meters pending the settlement of the weights and measures law; but it now recommends the Council to take it up with a view to relieving the industry of a too oppressive impost.

The Committee have considered the standardization of sizes of meters, so as to make those of different makes more readily exchangeable than at present. Dr. Leybold has measured the most prevalent sizes of wet gas-meters as made by seven different works; and from the tabulated measurements, it appears that the divergences from the mean figures are not considerable. It may therefore be hoped that small changes presenting no special difficulties may be agreed to by the meter makers, in order to secure the advantage of uniform outside dimensions for all makes of gas-meters of the same capacity. Importance is attached also to unification of the meter-unions. The Committee are negotiating with firms of meter-makers in regard to these points.

Owing to the engagements of members, the Committee have only been able to sit twice, and on each occasion had the advantage of the collaboration of Dr. Meyer, the representative of the Imperial Standards Commission. Of the sum of 500 marks (= about £25) granted to the Committee last year, only 322·9 marks have been expended. The Committee propose to continue work on the questions dealt with in their report. They asked for and obtained a grant of 600 marks (= about £30) for their expenses during the ensuing year.

The report is signed by Herr C. Kohn, of Frankfort, the Chairman of the Committee.

IV.—Committee on Working of Water-Works.

The Committee have thoroughly studied the provisions of the scheme for a new water law promulgated by the Prussian Ministry of Agriculture. After a sitting in Leipzic in October last, they held a joint meeting, with other interested bodies, in November in Berlin. As a result of these deliberations, the Committee compiled a statement of the views and wishes of the Association in regard to the projected water law, which, after a few changes, was transmitted in January to the Prussian Ministry of Agriculture with a covering letter suggesting that opportunity should be afforded for representatives of the Association to discuss the matter with the Minister.

The Committee have been busy collecting data for the twentieth issue of their volume of water statistics, in regard to which it sends out 514 sets of questions to water undertakings. Answers have already been received to 374 sets. In view of the fact that the "Statistical Annual" of German Towns contains particulars of water-works, the Association asks the co-operation of members in furnishing it with the required information promptly, so that its own compilation may be the first in the field.

The Committee are still investigating the question of fractures of town water-mains, and cannot yet give any definite conclusions

thereon. They are obtaining information from a number of managers of gas and water undertakings. It has been decided to include in the forthcoming volume of water statistics particulars of the population of the districts supplied, details as to the boiler grates and methods of stoking, and whether the boiler fuel is examined periodically and, if so, with what result. Particulars are also being asked for in regard to plant for the removal of iron from water, with details of the amounts present in the untreated water and in the filtrate, and its state of combination.

The report is signed by Herr Reese, of Dortmund, the Chairman of the Committee.

V.—Electrolysis Committee.

This Committee have not carried out work on their own account this year, because the "United Vagrant Current Commission" had not yet completed its labours, and questions brought before the Committee were also referred to it. The full report on the investigations completed before the formation of the aforementioned Commission has not yet been finished, owing to Herr Besig, the Engineer who is compiling it, having been much engaged in the work of that Commission. It is so far advanced, however, that it will soon be completed; and in view of the general interest which it is likely to arouse, it has been decided to publish it as an independent *brochure*. Investigations are at present being carried on at Warsaw, Beuthen, and Düsseldorf—Warsaw has been chosen as a large town in which there was no electric tramway at the time the investigations were started. Researches have already been carried out at Brunswick, Nuremberg, and Cassel. It is hoped the United Commission may be in a position to formulate its conclusions within twelve months.

The report of the Committee is signed by Mr. W. H. Lindley.

VI.—Instructional Committee.

This Committee have not undertaken any new work during the year, but have been content to follow up their previous efforts. Instruction in methods of lighting and in the working of gas-works may be divided into the course for graduates at the Technical College at Carlsruhe and the training for gas-fitters and foremen given at various technical schools. As regards Carlsruhe, students who intend to take up the gas industry for their vocation find here a course of study of which details have been given in earlier reports. Commonly, however, engineering students do not, until their academical studies are finished, decide to turn to the gas industry, and they then require special training for it. A course has therefore been established, extending over two academical half-years, for those who have already received general engineering training and wish to devote themselves to lighting or the gas industry. At the present time, twelve students are taking this course. There is also a fortnightly holiday course for persons engaged in the gas industry. This is held in March; and in the last one, 33 gas managers and engineers participated.

The syllabus of the course is as follows: The mornings of the first and of part of the second week are devoted to lectures by Professor Bunte on the "Technology of Gas Manufacture and the Use of Gas for Lighting and Heating Purposes," and by Professor Eitner on the "Methods of Examination of Coals, Gas, Bye-Products of Gas Manufacture, Boiler Feed-Water, and Lubricating Materials, as well as Calorimetry and Photometry." The afternoons of the first week are devoted to practical laboratory exercises—viz., first day, coal analysis and calorimetry; second and third days, analysis of coal gas; fourth day, analysis of liquor, purifying material, and cyanogen sludge; fifth day, water analysis, and the purification of feed water, and sixth day, photometry and calorimetry of gases. In the second week, there are practical exercises in the Instructional and Experimental Works of the Association, including the investigation of the working of a retort-setting by analysis of the gases, and measurements of temperature and draught, analysis of coal gas, and analytical methods for the control of the washers, purifiers, cyanogen recovery plant, &c., and for the examination of the bye-products, and the testing of the illuminating power, calorific power, and specific gravity of gases and the photometry of lamps of various kinds, including the determination of hemispherical illuminating power. On two afternoons of the second week, the Director of the Botanical Institute of the College (Herr Klein) teaches the principles of the bacteriological examination of water. Professor Eitner also conducts visits to the gas-works at Pforzheim and Heidelberg for the study of different systems of water-gas manufacture and practical novelties in working.

The Instructional and Experimental Works of the Association are, as their name indicates, intended partly for instructional purposes; and illuminating engineers who are qualified, by having passed through the full special course at the Technical College, are admitted to assist in the scientific operation of the works. They thus gain familiarity with plant and the scientific investigation of practical questions of gas manufacture.

At Altenburg, half-year courses of training for gas and water fitters are held, which include visits to several gas-works, and a few weeks practical working in one of them. At Bremen, three courses of instruction for gas fitters and foremen are held; the attendances this year numbering 35, 39, and 50. Opportunity was afforded for practical experience on small and moderate-sized gas-works. There was also a course of instruction in the erection of retort settings, attended by 9 pupils. At Breslau, a course of training for fitters has been started, primarily intended for pupils under 17 years of age. It extends over three years, and occupies six hours a week. There are now 42 pupils. At Cologne, there has been for the past two years a course of instruction for gas, water, and electricity fitters, held in connection with the United Royal Engineering School. The course extends over only three months, of which the first is devoted to preliminary instruction, and the last two to the special technical training. Difficulty has been experienced in the lack of general and technical education of many of the pupils who enter for the course. Admission to the course has been limited to those having some practical acquaintance with gas-works and knowledge of gas manufacture, and other persons desiring to avail themselves of the course merely to secure some small official post have been refused. At Dessau, the school established by the German Continental Gas Company now only gives a course of four weeks' instruction in the erection and working of vertical retorts. At Munich, a course of instruction on three evenings of the week, from 6 to 9 o'clock, was given, starting in October and ending in April. There were 27 pupils, of whom 16 were employed on the gas-works, and 11 in private workshops.

The report is signed by Dr. W. von Oechelhaeuser, the Chairman of the Committee.

VII.—Committee for the Instructional and Experimental Gas-Works.

After a reference to the book value of the works and the provision of the capital, this Committee report that some changes which had been found desirable in the plant were considered. A gasholder capable of holding one day's output of the plant was needed, and the town of Carlsruhe was asked to provide a further strip of land adjoining the present works as a site for the holder. The Corporation gladly granted the necessary land, for which the Committee express their sincere thanks. The plant has also been overhauled with a view to more rapid working. By reducing the duration of time required for an investigation, the capacity of the plant could be raised, and a great saving of material, wages, and superintendence effected. This has been done, *inter alia*, by effecting experimental changes more quickly, and establishing conditions of steadiness sooner after making a variation than was formerly possible.

In regard to the work accomplished, attention is first directed to the report on the Chemical Examination and Carbonizing Tests of German Coals. These coals were mostly obtained direct from the pits; and in several cases the freight was defrayed by the colliery owners or syndicate. There has, however, been some difficulty in obtaining a sufficiently representative number of Silesian coals. A new phase of the work was, however, entered upon in the autumn of 1908—viz., an attempt to formulate a method for the industrial valuation of gas coals. The Industrial Alliance of Cologne provided waggon loads from different gas-works of 19 gas coals from the Rhenish-Westphalian coal field as typical of the consignments received. Similar samples of consignments of Saar and English coals will follow for comparison. The object is to find a basis for the comparative valuation of the different coals with a view to fixing the prices to be paid for them according to their true relative industrial value. The examination of gas coals for the time being is keeping the staff and plant pretty fully engaged, and much other interesting work has been deferred. A number of coals, however, have been examined for private persons or firms, who have defrayed all the costs of such examination.

It is recorded that the firm of J. Pintsch, of Berlin, have (free of charge) replaced the old station-meter by a new recording one; the firm of Junkers have presented one of their latest pattern automatic calorimeters in place of an older one. Other apparatus has been given from various quarters for use at the works.

Chemical and calorimetric testings of a large number of samples of coal and coke have been made, and many lamps and burners have been tested photometrically. The works have also carried out an exhaustive investigation of the working of the Bolz vertical retort installation at Trieste, on which a report has been issued. Other matters investigated include the use of coke-oven gas for the supply of towns for lighting, heating, and power purposes, the suppression of smell in the revivification of fouled oxide, and the depreciation of water-gas plant. The report also refers to the instructional work conducted at the Experimental Works, already mentioned in the report of the Instructional Committee.

Several changes have been made in the staff of the works. Dr. Henseling, who had been in charge of it since 1907, retired, to take up other work, in May last, and Dr. K. Bunte (a son of Professor H. Bunte) was appointed to succeed him. Dr. Spreng left the works for an appointment at the Dantzic Gas-Works, and Herr Schilling took his place. On May 1, Herr Sentke, an Assistant-Engineer at the Chemical-Technical Testing and Experimental Works of the Grand Duchy of Baden, joined the staff of the Association's works.

The report is signed by Herr F. Reichard and Professor H. Bunte, by whom the works are controlled for the Association.

Wood preservation in the United States in 1908 required over 56 million gallons of creosote and nearly 19 million pounds of zinc chloride, with small quantities of crude oil, corrosive sublimate, and other chemicals. Nearly seven-tenths of the creosete was imported—mainly from England and Germany.

A FRENCH RETORT CHARGER-DISCHARGER FOR SMALL GAS-WORKS.

A system of charging and discharging retorts, the invention of M. Villain, was the subject of a paper by M. Bitard read at the recent meeting of the Société Technique du Gaz. He describes in words the working of the machine shown in the illustration, but such a task is not too easy or too interesting without the aid of diagrams and explanatory drawings or photographs. However, our summary of the paper will give its most salient features.

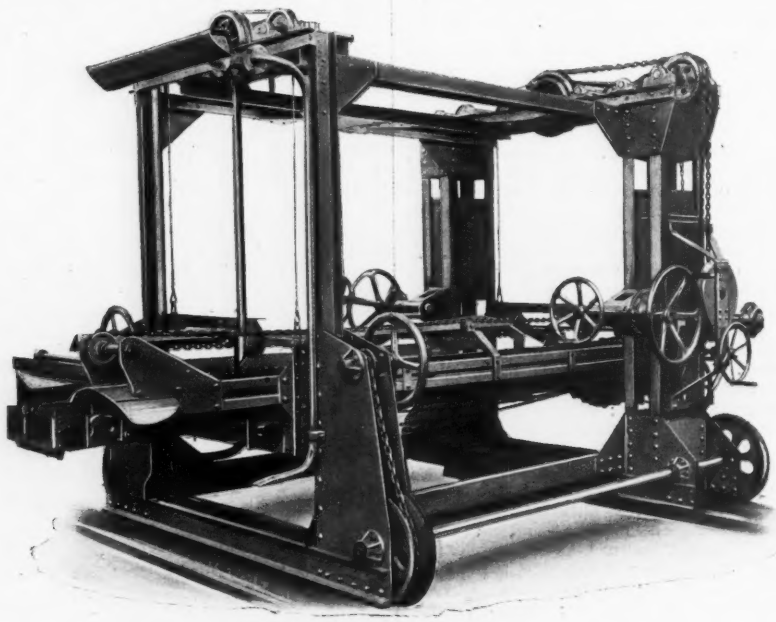
M. Bitard remarks that up to the present charging and drawing machines have been used at only very large works. They are generally operated by motors which make them rather expensive; they necessitate costly mechanical plant for conveying coal to them; and they require a special staff to attend to them. It would be of great advantage to have mechanical charging and discharging available for even the smallest gas-works. He has accordingly directed his attention so as to have the most suitable mechanisms to ensure perfect carbonization owing to the best possible distribution of the coal in the retort, and to allow of the heaviest charges being put in. Simplicity and smoothness of working were also aimed at.

The two appliances are worked by hand-wheels or handles. One man is enough for working them, as the accessory mechanisms are automatically thrown in and out of gear. The question of cheaply feeding the machine with coal was gone into; and an excellent method of supplying the charger with coal from a skip was found. It is also exceedingly practical. The skip is hung on a travelling trolley on an overhead mono rail. A heavy load can thus be easily moved. The type of skip adopted has three compartments, each containing one charge. Three charges are thus carried in one journey; the loading being done once and for all in the coal-stores.

Charging Apparatus.

The principal organ or charging scoop consists of a very extended plate of flattened U shape, which holds the coal. The scoop is divided into a certain number of compartments by cross partitions, fastened by hinges on to a beam in the centre of the cross section, and controlling throughout its length the scoop to be filled with coal. These partitions are arranged so as to lean towards the front of the scoop. The beam is independent of the scoop, and is supported at the back end by a small carriage. There are therefore two distinct parts: (1) The scoop itself; (2) all the door-partitions, of which the carriage occupies the back position, behind that which holds the coal.

The apparatus works as follows: The scoop being filled with coal throughout the length of its partitions, the scoop and the door partitions are together driven into the retort. When the front of the scoop arrives at the bottom of the retort, a special arrangement hits against the back of the carriage partitions, and keeps all this system in place in the retort while the scoop itself is brought back. On the return, the charge of coal which is kept in position by the partitions is run off the front of the scoop as it is withdrawn. The partitions have no other object than to weaken the effect of the filling of the coal, which would tend to be brought to some extent to the front of the retort. When all the coal has been thrown off into the retort, at the moment when the front of the scoop passes the fixed partition, the set of door-partitions is brought back to again take up its former position in the scoop.



Villain's Retort Charger-Discharger.

Accessory mechanisms consist in the series of abutments of the partitions, and their automatic return. Without describing these in detail, it may be said that the former consist of a cross bar on the back of the carriage door-partitions, a rack fastened on the front of the scoop, with notches against which the bar strikes so as to free the whole system. The latter is effected by means of chain tackle being brought into play at the moment when the whole of the coal is thrown off into the retort, and the scoop has a certain length to go before reaching a position of rest. The working of the pulleys actuating the movements of the scoop is fully described in the paper.

The scoop is supported by a framework which can be raised or lowered by a windlass to suit the different heights of the retorts. This framework is common to both the scoop and the rake of the discharging part of the apparatus. It consists of two frames with gusset plates in the intervening space, between which the travelling rollers run for moving the machine longitudinally from one retort to the other. The suspension ropes are fastened to the upper cross-bars of the framework. The scoop is guided in the direction lengthways of the retorts by means of rollers. At a given moment, when it has entered a certain length into the retort, all the front of the scoop is swung beyond the control of the rollers on the frame. To avoid any swinging, a fifth roller running on the floor of the retort is arranged under the front of the scoop.

The movement of the scoop is minutely detailed by the author. It is effected by a chain working over a pulley and driven by a hand-wheel, which by a special arrangement is kept always at the same height from the ground, for convenience in working. The introduction of the scoop into the retort is managed by a second wheel; and it takes less effort to effect it than to withdraw the scoop from the retort, as in the latter case there is the friction with the coal to be overcome.

The charge of coal put in the retort by the machine is thinnest on the cross centre line, while the layer is as high as possible along the sides of the retort. This ensures the greatest possible width of contact, and achieves the most advantageous section.

The scoop is charged either by shovel or by a skip. In the latter case, the coal can be spread partly automatically as the scoop is entering the retort.

Drawing Apparatus.

The drawing rake consists of a set of three hinged plates fastened at the end of a rod, so that they may take up the least possible room in passing over the coke in entering the retort, and yet at the end can take hold of the bottom of the charge and draw it out. It is the middle plate that has the adapting hinge; the other two side plates being made so that they can turn within a limited angle. The cross contour of the three plates is such as to conform with the arch of the retort while entering it. At the bottom of the retort, the side plates open out under the pressure of the mass of coke, which produces an enlarging effect, so that all three plates fill the width of the retort. The middle plate controlling the side ones is raised or lowered by means of a connecting rod to which it is fastened; the rod being also connected to the end of the working rod. The parts played by these two rods are fully described in the paper, as well as several ingenious mechanical devices in relationship with them.

The methods of support and of movement of the drawing apparatus are similar in principle to those already mentioned for the charging machine. The rake is supported at the back by two flanged rollers, the axle of which is fastened to the end of the rod. At the front is another roller, on which the rod rests. The method of balancing the rake is also similar to that used for the charging apparatus; but as the additional roller could not run over the surface of the coke, a path for it is provided by means of a special bar running alongside the rake rod.

The moving power is transmitted by an endless chain, passing over one pulley at the front and one at the back. When the rake is in position in front of a retort, the sustaining bar is first run to the bottom and then the rake itself is admitted. When it has got to the end of its stroke and the lowering of the plates has been done, the sustaining bar is brought back. Then the rake is worked so as to bring out the charge.

The hand wheels and windlass are the same as are described for the charging portion of the machinery. The frame is kept in equilibrium by two counterbalance weights, with chains working over a drum.

The apparatus is completed by a quenching arrangement fixed on the framework above the position for the coke waggon, and so that the drawing rake also can be cooled on coming out of the retort.

LYONS ELECTRIC AND POWER SUPPLY WORKS.

In the course of the notes which appeared last week on the visits paid by the members of the Société Technique du Gaz to the works of the Lyons Gas Company, on the occasion of the holding of the thirty-sixth annual congress in that city, it was mentioned that the Company's electricity stations were also inspected. It may be of interest to give some particulars of these establishments, to supplement those which have already appeared in regard to the gas-works.

The Company possess four stations, named respectively the Gazomètre, Pazzi, Rambaud, and Tronchet. The first three have each a section producing current by means of steam-driven plant, and another for transforming the current furnished by the Société Grenobloise de Force et Lumière, to which further reference will be made later; while the last is used exclusively for the transformation of the surplus continuous current of the Omnibus and Tramways Company, delivered at a pressure of 600 volts. The three-phase current at 50 periods of the first-named Company is brought to 10,000 volts at their transformer station at Vaulx-en-Velin, in the suburbs of Lyons, and delivered by underground cables to the gas-works at Villeurbanne, whence it is sent first to the Gazomètre station and afterwards to the Pazzi and Rambaud stations—the latter being at the head of the suburban network of cables. The three-phase current received by the Gas Company is transformed into continuous current at 230-260 or 260-290 volts. The current produced by the stations themselves for feeding the urban cables is continuous, at low tension. When the current from the Power and Light Company fails, the Gazomètre and Rambaud stations are capable of generating three-phase currents at 10,000 volts (50 periods) for the suburban canalization. When the current reaches the various communes it is distributed on the four-wire system, after having passed through static transformers which lower the pressure either to 208 volts for motive power, or to 120 volts for lighting purposes. In order to ensure perfect regularity of the service, the stations are furnished with powerful batteries of accumulators, which have acted so well that there has been no interruption of the current since the first machine was started in 1888, notwithstanding a few accidents which cannot be avoided in the most carefully conducted works. With these prelimary remarks, we will proceed to describe the different stations.

The oldest and most important station is the one named after the street in which it stands—the Rue de Pazzi. It is situated in the centre of the city, in an old quarter, in which the streets are very narrow. It was equipped in 1887; but it has since undergone considerable improvement, especially in 1898, when the Gas Company's concession was renewed. The production of current is ensured by seven groups of generators, representing a total of 2700 H.P. (1800 kilowatts), consisting of compound condensing engines coupled direct to shunt dynamos with interior poles, supplied with steam by eight coke-fired Naeyer and Niclausse boilers, having a total heating surface of about 18,000 square feet. There are five accumulators—two equal respectively to 1600 and 3400 ampère-hours, and the others equal to 4140 ampère-hours each. The portion of the station devoted to the transformation of the current is furnished with three groups of transformers, composed of a three-phase Thomson-Houston motor of 500 H.P. at 500 revolutions, coupled up to a Thury dynamo of 300 kilowatts. These machines are so arranged as to give sufficient pressure to charge the accumulators without the interposition of boosters.

The Gazomètre station is situated on the left bank of the Rhône, in the Guillotière quarter. It was established in 1898. As in the case of the Pazzi station, it consists of two sections—one for the generation, the other for the transformation of current. The former is effected by five groups of continuous-current generators of from 260 to 290 volts, having a total capacity of 2500 H.P. (1700 kilowatts). The most powerful of them works with superheated steam at 250° C., and it can furnish either continuous current at 260–290 volts by a dynamo, or three-phase current at 10,000 volts by means of an alternator. Steam is generated by seven coke-fired Niclausse and Bonnet-Spazin boilers, having a total heating surface of 14,430 square feet. The station is provided with two batteries of accumulators—one of 162 elements of 1100, the other of 160 elements of 1380 ampère-hours. The receiver portion of the station has two rotary transformers, of 500 H.P., running at 500 revolutions per minute, each composed of a three-phase motor of 10,000 volts, driving a 300-kilowatt continuous-current Thury generator, the pressure of which can be raised sufficiently to charge the accumulators without the interposition of boosters.

The Rambaud station is close to the Perrache works of the Gas Company. It is of comparatively recent construction, and has been arranged for the production simultaneously of three-phase and continuous currents. It contains four groups of generators, two of 50 H.P. (40 kilowatts) and two of 250 H.P. (170 kilowatts), capable of producing either continuous current at 230 to 260 volts for the supply of the immediate neighbourhood, or three-phase current at 140 to 160 volts, the pressure of which is raised to 10,000 volts by three transformers of 115 kilowatts. The two coke-fired boilers at the station have a total heating surface of 3874 square feet. From this station is obtained the current required for driving plant at the gas-works.

The Tronchet station dates from 1900. It contains two rotary transformers of 125 kilowatts, each composed of a motor of 190 H.P., worked by current obtained from the Omnibus and Tramways Company, actuating a continuous current dynamo of 260 to 280 volts. Its pressure may be raised to 400 volts for charging the two accumulators, each of 154 elements of 1100 ampère-hours. This operation may also be effected directly by the Omnibus Company's current by employing a step-down transformer.

The network of cables is composed first of all of various feeders starting from the four stations. They are 16 miles long, and supply cables which, in Lyons alone, extend to 66 miles. From the urban network of mains more than 10,000 lighting consumers, using 170,000 lamps of 10-candle power, or their equivalent, and a certain number of power users, are supplied. It may be noted that the 23 feeders from the Pazzi station constituting the principal distributing plant of the Gas Company, do not all work in parallel, but are divided into five groups, in order to minimize the risk of interruptions of the supply in case of accident. The suburban network consists of nearly 40 miles of high-tension and 120 miles of low-tension cable. But it is continually being extended *pari passu* with the development of the works and the acquisition of fresh concessions by the Company. The electric lighting of the city, which is confined to some of the principal thoroughfares, is in the hands of the Société Lyonnaise des Forces Motrices du Rhône and the Gas Company. The latter furnish current for about 80 arc lamps, a certain number of which are placed upon candelabra arranged for simultaneous lighting by gas and electricity.

The station of the Motive Power Company just referred to is situated on the Canal de Jonage, at Cusset, in the outskirts of Lyons. The canal is an arm of the Rhône, and it took four years —from 1894 to 1898—to construct. It is 11½ miles long, and from 200 to 330 feet in width. The volume of water derived from the Rhône varies, according to the height of the water, from 22,000 to 35,500 gallons; and the depth of the fall at the Cusset works is from 30 to 40 feet. The canal was conceded to the Company on July 9, 1892. A compensating reservoir about 400 acres in extent serves for the storage of water during periods of small consumption, and facilitates the regular running of the works. The hydro-electric plant consists of three exciters of 260 H.P. and sixteen turbines of from 1260 H.P. to 1600 H.P., actuating 16 three-phase alternators of similar power. The electric energy is distributed in Lyons and to the suburban communes by means of a primary network of cables at 3500 volts, and by a secondary network at 110 volts. The length of the underground conduits is 315 miles. In the twelve months ending Dec. 31 last, the works produced current equal to 432 million hectowatt-hours. At present the Company supply 3307 customers with motive power equivalent to an installation of 24,244 H.P., and 9466 lighting customers using 247,400 lamps of 10-candle power. The total revenue of the Company last year was £191,800.

In an earlier part of this article, reference was made to the Société Grenobloise de Force et Lumière. The Company have five stations, the capacities of which range from 4000 to 10,000 H.P. At one of the stations, the depth of the fall of water is 75 feet, and at another about 215 feet. The Company's overhead distributing lines extend to a length of 420 miles; and they transmit either three-phase current (50 periods) at 26,000 and 40,000 volts, or continuous current at about 50,000 volts. The centres of distribution are mainly in the industrial quarters; the Company's principal customers being the Tramways and Gas Companies. The motive force subscribed for is equal to 18,000 H.P. The Company supply about fifty rural communes.

It should have been noted last week that, among the "King's Birthday Honours," was the conferring of a knighthood on Mr. R. H. Inglis Palgrave, F.R.S., the Chairman of the Great Yarmouth Gas Company, the Editor of the "Dictionary of Political Economy" and a noted writer on banking subjects.

ORIGIN AND PROGRESS OF GAS LIGHTING.

Paper by a Former Norwich Gas Manager.

The occupancy of the presidential chair at the recent meeting of the Institution of Gas Engineers by Mr. Thomas Glover, of Norwich, the account given in his Inaugural Address of the new departure in carbonization which he is making there, and the inspection of his works by the members of the Institution at the close of the meeting, have caused special attention to be turned to the ancient cathedral city in which Mr. Glover's professional duties are discharged. It may therefore not be without interest, as furnishing evidence of what one of his predecessors in the management of the gas-works—a Mr. Tadman—did to enlighten the citizens on the subject of coal gas, to reproduce portions of a paper read by him many years ago on "The Origin and Progress of Gas Lighting." The manuscript, courteously placed at our disposal by Mr. Glover, contains references to two Norwich men who were among the early inventors of plant connected with the utilization of gas.

Among the diversity of subjects which agreeably occupy attention, while they afford a rational gratification to the mind, the most interesting are such as relate to the progress of human improvement. The history of discoveries in science, or inventions in art, must therefore be deserving of particular regard; for Genius is here exhibited unfolding her energies and displaying the variety of her resources. The arts of civilized life so essentially contribute to happiness, that it is natural men should be desirous of tracing them through the various stages by which they have advanced in their career. As the application of so subtle a body as coal gas to the purposes of public and domestic illumination is one of the most singular and happy contrivances of modern ingenuity, some account of its discovery, and the means by which it has been progressively brought into notice, may tend to gratify rational curiosity. It has become a subject so important as to create a high degree of interest; and from the extensive employment of gaslight, which is so clear, soft, and agreeable to the sight, it seems to be peculiarly adapted to the useful occupations, while it conduces to promote the social pleasures and domestic comforts of man. Indeed, it may be asserted that the lustre of its beams dispels to a considerable extent the gloom of night, and restores the cheerfulness of day—exciting those pleasurable feelings that animate to action and to enjoyment.

Formerly the inflammable gases were known rather by the direful effects which they so often produced than for useful qualities. Two of them, which form constituent parts of coal—choke-damp and fire-damp—had been known to miners long before the establishment of the Royal Society; but the earliest notice of either in their "Transactions" is in the year 1667. It is entitled: "A Description of a Well and Earth in Lancashire taking Fire by a Candle approached to it. Imparted by Thomas Shirley, Esq., an Eye-Witness." There can be little doubt that the bright and vigorous flame which the writer described proceeded from what we now call carburetted hydrogen, or coal gas. Some interesting circumstances relating to the properties of coal gas are detailed by Sir James Lowther in a paper in the "Philosophical Transactions" for 1733. The writer of this narration described with remarkable minuteness and precision the principal properties of coal gas as he exhibited them to different members of the Royal Society, and evinced that the gas retained its elasticity and inflammability after keeping it for some time. But, notwithstanding these striking appearances, there seems to be no evidence that the philosophers of that period undertook any experiments with the view of applying it to useful purposes, or even suggested any idea to the world. One of those fortuitous occurrences, however, which have often led to important discoveries, was the occasion of the properties of coal gas being better known and more particularly attended to. The circumstance is detailed in the "Philosophical Transactions" for 1739, in an extract from a letter by the Rev. Dr. John Clayton. He calls the gas the "Spirit of Coal," and discovered that it was inflammable from its having accidentally caught fire by coming in contact with a candle as it was escaping from a fracture in one of his distillatory vessels while he was endeavouring to repair the luting. He carefully enumerated the several substances produced by his distillation; and by preserving the gas in bladders he frequently diverted his friends by exhibiting its inflammability when lighted by a candle. By this discovery of Dr. Clayton, some of the most striking and the most valuable properties of coal gas are displayed. But he seems to have entertained no suspicion of the useful purposes to which the gas has since been applied; and, remarkable as were the circumstances which he so minutely and accurately related, it does not appear that they attracted any particular notice at the time of their publication. In 1767, the subject engaged the attention of Dr. Richard Watson, afterwards Bishop of Llandaff, who published the result of his researches in the two volumes of his "Chemical Essays." His experiments show that he examined with great care the products arising from the distillation of pit coal; and he described them with his usual exactness. After detailing a variety of interesting facts and calculations respecting the quantities of coke, tar, &c., produced from various kinds of coal, he put forward several useful queries to excite others to investigate the subject with a view to further discoveries. Dr. Watson's experiments on coal probably caused Lord Dundonald to make the experiments on which his patent was taken out for manufacturing mineral tar.

Hitherto we have had only a faint glimpse of that beautiful light which at a future period was destined to be exhibited in such splendour, and to be so extensively subservient to the public benefit. However, both art and science are in their nature necessarily progressive. Thus the advantages to be derived from the useful qualities of coal gas were not obvious to those who first discovered them; and many years elapsed before they were distinctly perceived and duly appreciated. Mr. Murdoch, of Soho, has the singular merit of being the person who first applied this gas to any economical purpose; and he also exhibited the mode in which it might be employed, instead of lamps or candles, for all the useful purposes of artificial lighting. In the year 1792, he used coal gas for lighting his house and offices at Redruth in Cornwall; and in 1797 he again made a similar use of it at Old Cumnock, in Ayrshire. At that large establishment, the Soho Foundry, near Birmingham, in 1798, he constructed an apparatus which enabled him to exhibit his plan on a larger scale than any which he had hitherto attempted. His experiments were sedulously continued with a view to ascertaining not only the best modes of making, but also of purifying and burning, the gas, so as to prevent the smell and the smoke from being offensive.

Mr. Murdoch had many difficulties to overcome before he attained perfection. But, as he united scientific knowledge with great practical skill, his perseverance enabled him to triumph. The retort he first used was similar in form to the common glass retorts usually employed in chemical experiments. He next made trial of cast-iron cylinders, which he placed perpendicularly in a common portable furnace; and they were calculated to contain about 15 lbs. of coal. In 1802, however, he had recourse to the horizontal mode of setting them. In 1804 and 1805 he varied his plans, and constructed his retorts with an aperture door at each end—one of them for introducing the coal, and the other for taking out the coke. But this method he found both inconvenient and troublesome. In the works which were constructed in 1805 and 1806 for Messrs. Phillips and Lee at Manchester, he tried a retort of a different kind, which was very large, and had the form of a bucket with a cover to it. Into this a loose grate or iron cage was introduced for the purpose of holding the coal; and by this contrivance the whole of the coke could at once be heaved out of the retorts when the carbonization was completed. This was so capacious as to contain 15 cwt. of coal; but afterwards smaller sizes were tried in an elliptical form. These were found to answer much better.

Though Mr. Murdoch engaged in his experiments on coal gas so early as the vear 1792, and in some subsequent years had even applied it to lighting up his office at Redruth and Cumnock, as well as at Soho Foundry, he made no effort to excite the attention of others to the subject till he was prompted to that remarkable exhibition of it at the Peace of 1802. Previously, however, to this public display by Mr. Murdoch, gas had been applied to similar purposes by M. Lebon, of Paris. This is important in the detail of its history; but it does not detract from the merit of Mr. Murdoch, nor lessen his claim to the honour of being the first person who introduced the application of gas to useful purposes on a large scale in this country.

In 1803 and 1804, Mr. Winsor, who had laid claim to gas lighting as his discovery and invention (though probably he derived all the information he possessed relating to gas chiefly from Lebon, whose assistant he had been for some time in Paris) publicly exhibited his plan of illumination by coal gas at the Lyceum Theatre in London, where he delivered lectures on the subject, which he illustrated by a number of experiments. He afterwards removed his exhibition to Pall Mall, where, early in 1807, he lighted up a part of one side of the street. This was the first instance of this kind of light being applied to such a purpose in London. He was also the projector of a National Light and Heat Company. Having obtained a patent for his plan, he published some pamphlets to recommend it. It has been stated that Mr. Winsor raised nearly £50,000 by subscriptions for establishing his Company; but, large as was the amount, he was not enriched by it, for the whole was expended upon his projects. In proportion as gas lighting occupied more of the attention of scientific men, the illuminating and other qualities of gas became more frequently the subject of discussion. The advantages and inconveniences attendant upon its use as a medium of light were rigidly examined and scrutinized; and every examination rendered its importance and utility more strikingly evident.

In the year 1805, Mr. Samuel Clegg, having left Soho, directed his attention to the construction of gas apparatus; and the first he erected was at the cotton mill of Mr. H. Lodge, near Halifax. His practical knowledge and ingenious contrivances not only contributed to improve the practice but to give an impulse to the more general adoption of this mode of illumination. In 1806, Mr. Josiah Pemberton, a very intelligent and ingenious man, had employed himself for some time in the contrivance and construction of gas apparatus. The first that he erected in the way of business was for Mr. Mark Saunders, an eminent button manufacturer; and its purpose was not only to light his manufactory, but also to afford the necessary heat for soldering the shanks of buttons. It so completely attained its object that it was in use

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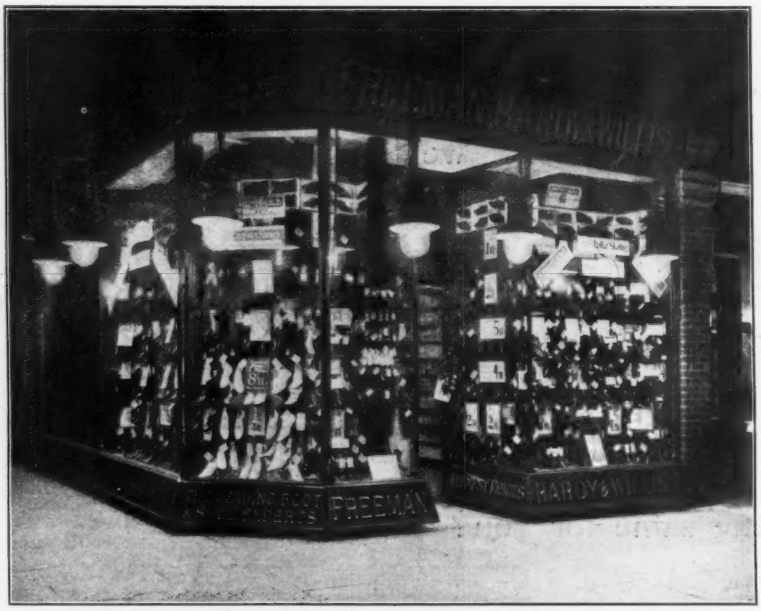

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for more than twenty years afterwards with no alteration; and it required very few repairs. In 1808, he also constructed and fixed a gas apparatus that was applicable for several uses for Mr. Benjamin Cook, a manufacturer of brass tubes, gilt toys, and other articles in which a great deal of soldering was required. This answered its purpose so well that Mr. Cook gave an account of it in "Nicholson's Journal." In the course of the same year, Mr. Pemberton erected other apparatus for different manufacturers and to serve for various purposes; but soon after this he discontinued the business of manufacturing gas apparatus.

The year 1809 was memorable as the era when the first application was made to Parliament for an Act to incorporate a gas company for the purpose of more effectually and beneficially carrying on its processes. This is a remarkably important fact in its history; for it was the foundation of the "London and Westminster Chartered Gaslight and Coke Company." The capital proposed to be raised at that time was £200,000; and this sum was stated to be fully adequate to effect all the objects they then had in view. The persons who applied for the Act to form them into a company had many difficulties to combat, arising both from interest and from prejudice. Their projects were represented as visionary, and the execution of them attended with considerable danger; and hence some alarms were excited which, in conjunction with various other causes, operated against the success of their application. They were opposed by Mr. Murdoch, on the ground of priority of right to the discovery, which entitled him to exclusive privileges if he chose to avail himself of the advantage; and this gave rise to a long and minute investigation before a Committee of the House of Commons. The evidence of Messrs. Accum, Humphry Davy, Lee (of Manchester), James Watt, and many other persons, was heard as to some of the minor points; and much useful information was obtained. However, the application terminated unsuccessfully; and it was attributed at the time partly to the impressions produced by the puffing extravagances of Mr. Winsor, and partly to the defective and erroneous evidence of Mr. Accum and others. Though in one attempt the applicants had failed to obtain legal power and authority to carry their extensive scheme into effect, their pecuniary interests in its success stimulated them to make further efforts. Consequently, in 1810 another application was made by them to Parliament; and though they encountered some opposition, and also incurred considerable expense, they succeeded in obtaining an Act to authorize His Majesty to grant them a Charter within three years from the time of the passing of the Act. Thus by perseverance the persons who were engaged in this great speculation succeeded in attaining the leading point they had so anxiously sought; and Mr. Winsor's plan of a National Light and Heat Company was in part accomplished by the legal formation of a local gas company.

On April 30, 1812, a Charter was granted to the Gaslight and Coke Company which enabled them to become a body politic for the term of 21 years, subject to the provisions and restrictions contained in the Act of 1810. Hitherto the labours of this Company had been attended with no profit and with very little fame; but they steadily pursued their plans, and made the necessary purchases of sites for their stations. They first obtained the one in Peter Street, Westminster, then that in Curtain Road, and lastly that in Brick Lane; and in order to extend the means and facilitate the more general adoption of gas lighting, they persevered in laying down the principal street-mains, and making such other preparations as seemed to be essential to the successful accomplishment of their purposes. Early in 1813, they had an opportunity of securing the able assistance of Mr. Samuel Clegg; and under his direction their principal works at all their different stations were erected. From this period various improvements were gradually introduced into almost every part of the apparatus and machinery as they were suggested by his ingenuity and great mechanical skill. Towards the end of 1813, an accidental explosion occurred at the works at Westminster, in which Mr. Clegg was seriously injured. In consequence of this accident, a Committee of the Royal Society was appointed to inquire into the cause of it; and their report was probably conducive to the advantage of both the gaslight establishments and the public.

About this time the City of London Gaslight Company was established; and two others were projected for the Metropolis—one in Southwark and the other in its eastern district. We are now at an era when the current of public opinion was strongly turning in favour of the new mode of lighting; for, as the knowledge of gas had become more widely diffused, the prejudices which had formerly prevented its adoption had been gradually overcome. As the Chartered Company's establishments had been considerably enlarged and were constantly extending, a proportionate increase of pecuniary means became requisite; and consequently, in 1816, they applied for power to augment the amount of their capital £200,000, which they readily obtained. But an additional restriction was imposed upon them, for their proceedings were subjected to the inspection and control of the Secretary of State for the Home Department.

Various considerations at this time induced men of science and skilful mechanics to aim at improving the apparatus employed in the operations of making and purifying gas, several of which exhibited the talents of the inventors. The person who first distinguished himself was Mr. Samuel Clegg. In December, 1816, he obtained the patents for his horizontal retort, apparatus for purifying gas with cream of lime, rotative gas-meter, and self-acting governor. All these were important inventions or improvements; and they essentially contributed to the art by laying the foundation of an improved system of management. Though the gas-meter was the original invention of Mr. Clegg, it has been materially improved by Mr. Samuel Crosley. The experience of several years has proved its advantages, both to the proprietors of gas-works and the consumers of gas; and its utility has been evinced by the regularity and accuracy of the operations by which its purposes are effected.

In the year 1817, Mr. Clegg retired from the service of the Gaslight and Coke Company; but he had then accomplished the erection and arrangement of the great works at their three different stations. During the four years that his abilities had been employed upon them, they had attained such a degree of perfection as to display not only the great capabilities of the art to which he devoted his talents, but also the probable advantages that would eventually be realized by its general adoption. Mr. Murdoch is undoubtedly entitled to the praise of having been the first person who applied gas as a substitute for other means of lighting large private establishments; but the merit of its first application to the illumination of a whole town appears to be due to Mr. Clegg. In the course of 1817, he planned and erected gas apparatus at the Mint. Mr. Brande gives some interesting facts relating to the progress of gas lighting in the Metropolis at this period, which exhibit the rapid and extensive advances then being made. He states that at the three stations belonging to the Chartered Gas Company 25 chaldron of coal were daily carbonized, producing 300,000 cubic feet of gas, equal to the supply of 75,000 argand lamps each yielding the light of 6 candles. At the City Gas-Works, in Dorset Street, the quantity used daily amounted to 3 chaldrons, adequate to the supply of 1500 argand lamps; so that 28 chaldron, or 35 tons, were daily carbonized at that time.

The subject which at this time seems to have excited the greatest degree of public interest was coal gas. The period was indeed prolific in schemes for its improvement; and several persons obtained patents for their respective plans. But its perfection was the object which principally occupied attention; and, though essentially important, this had certainly proved the most difficult to effect. One of the first of the patent plans was devised by Mr. D. Wilson, of Dublin, who, in 1817, obtained a patent for purifying coal gas by the chemical action of ammoniacal gas. Though this method proved efficacious for its purpose to a certain extent, it appears to have been attended with some inconveniences and difficulties, and was therefore never much introduced into practice. Another plan to purify coal gas was devised by Mr. Reuben Phillips, of Exeter, who in the same year obtained a patent for the purification of coal gas by the use of dry lime. This method was found to answer remarkably well; and it was adopted in Norwich at the commencement of the year 1830. Mr. Alexander Angus Croll, of the Brick Lane station of the Chartered Company, further improved the process of dry lime purification. Mr. G. H. Palmer took out a patent for a method of purifying coal gas which differed materially from any of the preceding plans. The gas was passed through iron retorts heated to dark red. These retorts required to be half filled with various oxidizable substances—such as broken pieces of cast iron, iron clippings or turnings, iron ore, or others of a similar nature. To deprive the gas of its sulphuretted hydrogen and carbonic acid seems to have been the primary purpose of this mode of purification; but the patentee had another object in view which was certainly very important—namely, to obviate the nuisance from the lime when saturated with sulphuretted hydrogen. This occasioned much annoyance to those who lived in the vicinity of gas-works. The plan was found to possess great disadvantages. The complicated construction of the apparatus and the nice attention it required might all combine to prevent its extensive use, whatever advantages the plan might seem to present. This gentleman erected the Yarmouth Gas-Works. Another method was suggested by Mr. Samuel Parker, of Liverpool. He did not employ oxidizable substances, but passed the crude gas through an arrangement of iron pipes placed horizontally in a furnace. This plan was tried, but did not answer. Mr. George Lowe, of Derby, purified coal gas by conveying it through an iron cylinder containing iron turnings, afterwards passing it through lime water.

Various plans were patented for the arrangement and setting of retorts. Mr. Perks, of the City of London Gas-Works, obtained a patent for his plan of placing twelve retorts with one in the centre, so that the whole thirteen could be heated at once. Mr. John Grafton, a pupil of Mr. Clegg, took out a patent for some improvements in gas apparatus. A part of his scheme consisted in constructing retorts which were open at both ends and lined with fire-clay. The plan has been further improved by substituting retorts made entirely of this material; and they are used at Cambridge, Colchester, and several other towns which Mr. Grafton has lighted. They are stated to be more economical than iron retorts.

Having pursued coal gas through all its vicissitudes from the earliest accounts of its discovery till 1817-18, and also having shown the various attempts to render it useful till its successful and extensive application was finally accomplished, circumstances intimately connected with the subject of gas lighting necessarily direct our attention to another interesting branch of the art—the introduction of oil gas. In 1815, Mr. John Taylor, a native of Norwich, obtained a patent for apparatus for the decomposition of oil and other animal substances; and as one of the contrivances was to procure gas from oil, the invention excited curiosity and caused a greater degree of attention to be bestowed upon

the subject. From some unforeseen difficulties which attended its operations, the apparatus could not be properly and successfully introduced till several years afterwards. One of the principal of these was the patentee finding that the iron retorts employed in the production of oil gas gradually lost the power to decompose the oil. This remarkable and unexpected change led, of course, to some investigations with the view of discovering the cause; and though the interior of the retorts was cleansed from all extraneous matter, it was still found impracticable to restore them to such a state that they would produce the proper and desired effects. But the experiments to which the circumstance gave rise were productive of the most favourable results, and led to the discovery that, if fragments of broken bricks or coke were introduced into the retorts, their capacity for decomposing the oil would greatly increase. Thus an important improvement was made in the process, and at the same time the serious apprehensions of the patentee were effectively removed. In 1819, Messrs. Taylor and Martineau erected their patent oil-gas apparatus at Apothecaries' Hall. In 1820, they commenced at Norwich; and in 1821, at Hull and Bristol. Leeds, Colchester, Leith, Bow, Whitby, and several other places were lighted from that time up to 1824. Norwich was the first oil-gas works upon a scale for lighting streets and public buildings. The Act was obtained in 1820.*

But to return again to coal gas, which, in consequence of the introduction of oil gas, was very materially retarded. The application of a company to Parliament for a Bill to empower them to light with oil gas the City of London and the Liberty of Westminster, under the style and title of the "London and Westminster Oil-Gas Company," with a capital of £900,000, occupied great public attention. It was submitted to the examination of the most scientific chemists, engineers, and other persons connected with gas-works—viz., Professor Leslie, Mr. George Lowe, Mr. Herepath, Messrs. Christieson and Turner, and a great number more—who gave their testimony respecting the value of coal and oil gas. After the expenditure of a large sum of money on both sides, the Oil Gas Bill was ultimately thrown out. After the settlement of the question of oil and coal gas—the value of the two gases being finally decided in favour of the latter—coal gas companies again commenced in earnest. From a return made to the Secretary of State in 1822, the following figures are taken:—

	Retorts.	Gas-holders.	Contents.	Coal Used. Chaldrons.	Rental.	Miles of Pipes.
Chartered—						
Peter Street.	300	15	309,385	9,282	£62,364	60
Brick Lane .	371	12	221,131	8,060	£44,790	40
Curtain Road	240	6	90,467	3,336	£18,823	25
	911	33	620,983	20,678	£125,977	125
City of London—						
Dorset Street	230	8	181,282	8,840	£30,839	50
Phœnix—						
Bankside .	164	6	115,675	3,640	£14,962	35
	1305	47	917,940	33,158 = 41,447 tons	£171,778	210

This will show that the three great Gas Companies in London were generating annually 397 million cubic feet of gas to supply the number of private and public lamps. In addition to these Companies, at that time the Imperial Gas Company were erecting at their Hackney station two gasholders of 10,000 cubic feet each, and were about to erect four more of the same size; while at their Pancras station, they had marked out ground for six gasholders of 10,000 cubic feet each.

Great numbers of companies which have been formed during the last few years for the purposes of gas lighting are cogent and striking proofs of the favourable opinion generally entertained of it. Almost every town of any importance in the United Kingdom has now one gas-light establishment and some of them more. The practice is now extending, and it is understood that more than 400 public gas-works are at this time in operation. I shall therefore briefly mention the Gas Companies at present established in London to show the great increase of gas lighting since the year 1822. The following are the names of fifteen Companies in operation in 1844:—

Companies.	Works.	Rental per Annum.	Coal Carbonized. Tons.
Chartered	3	£175,000	70,000
Phœnix	3	60,000	50,000
Imperial	2	120,000	60,000
British	2	30,000	—
City of London	1	65,000	46,000
Independent	1	37,000	
Equitable	2	—	226,000
The New London	1	40,000	
South Metropolitan	1	—	
United General	1	—	
Alliance	1	—	
Poplar	1	—	
Commercial	1	—	
Ratcliff	1	15,000	
European	1	—	

The supposed capital of the above-named companies (who possessed 22 works) exceeds £6,000,000; and the annual consumption of coal is more than 320,000 tons. I was lately informed by some of the superintendents of the large gas companies that gas lighting was then proceeding at such a rate that they found it almost impossible to keep pace with it. The alteration of mains and the increase of storage for gas required large outlays of capital. The Imperial Gas Company are erecting a large gasholder and tank capable of containing 500,000 cubic feet. They have now on their works one that will contain 300,000 cubic feet. The other gas companies are either erecting new gasholders or converting their old ones to the telescopic principle, giving them nearly double the capacity. This answers well on such works as are confined for room.

The author then referred to the properties of some of the gases generated in the manufacture of coal gas, and concluded as follows: In the preceding statement, an attempt has been made to arrange, as nearly as possible in the order of time, the principal facts and inventions connected with the rise and progress of the art of gas lighting. To estimate the many advantages which have resulted from its introduction would perhaps be impracticable; for, independently of the utility of its light, it has given a most important impulse to several branches of our national manufactures. The erection and adaptation of the numerous large works for its purposes have furnished employment to a large mass of our industrial population, and at the same time they have afforded many incentives to the exercise of ingenuity. But it has benefited the iron trade to an incalculable extent; and it has also occasioned a great consumption of metals of other kinds. Its operations have given rise to a large and flourishing branch of manufacture, by the demand for tubing, burners, and various other articles which that part of its processes has rendered necessary; and it may be worthy of remark that to no part of the nation has it been of more service than the town of Birmingham and its vicinity, where gas lighting was first publicly displayed. The spirit of enterprise which has marked its career reflects honour on our country. Notwithstanding that so much has been effected, the art is probably very far from that perfection which it may attain at some future period. It is fair to presume that the present meritorious endeavours widely to diffuse useful knowledge will have an appropriate influence upon that class of men who are more immediately engaged in gas operations, and enable them to add to the number of its improvements. And from the continual increase of establishments for gas lighting it seems not an improbable supposition that its use as a medium of light will ultimately be universal. It is a proud satisfaction to know that its adaptation to purposes of usefulness is entirely British; and by encircling it with freedom and encouragement, we may be able to extend its application, and by our perseverance and industry continue to set in this particular an example to all the nations of the world.

* At the time of the reading of the paper, a portion of the original apparatus was lying upon the premises; and Mr. Tadman stated that he first embarked as a gas-light man under the auspices of an oil-gas company.

A Street Lighting Experiment and an Omission.

There is no doubt great rejoicing among electricians who do not know the facts over the information published by the "Electrician" concerning a little street-lighting experiment that has been made in a road in one of the suburbs of Bath. An electrical paper announces (as though it were all on a scale of which it is proud) that "experiments" were recently made by the Bath Electricity Department to ascertain "the relative efficiency for street lighting of the present 60-candle power incandescent gas-lamps and 100-candle power Leuconium metallic filament lamps, made by the Stearn Electric Lamp Company." This is the important point—remember the metallic filaments are said to be of 100-candle power each, against 60-candle power for the incandescent gas-burners—"it was found the electric light was incomparably more brilliant, and that the area of diffusion was much wider." There is a little omission in our contemporary's notice that we should like to rectify. It is that, in place of the three 60-candle power gas-lamps taken down by the Electricity Committee, they erected five 100-candle power metallic filaments. Nor was any intimation of the experiment given to the Gas Company; so that the new metallics were compared with incandescent burners which had been in use in old-fashioned lanterns for some time in this suburban road. Our electrical friends should try to be fair by stating facts fully, and not suppressing essential ones.

A New Director of the Gaslight and Coke Company.—We learn that Mr. Joseph Lister Godlee, the Chairman of the West Ham Gas Company, has been elected to a seat on the Board of the Gaslight and Coke Company, to fill the vacancy caused by the recent death of Mr. Howard C. Ward.

Lighting of the City of London.—At the meeting of the Court of Common Council of the City Corporation last Thursday, the report of the deputation appointed to visit various cities on the Continent and inspect the lighting there, was advanced a further stage by the Streets Committee bringing up a short report on the subject, submitting the report of the deputation, and asking authority to print and circulate it for the information of the Court, without offering any opinion on it or on the suggestions it contains. The Committee's report was received *nem. con.*; and the report of the deputations, with the Grand Committee's recommendations, will be at once printed, so as to be in the hands of the members previous to it being discussed in Common Council at the next Court, on the 15th inst.

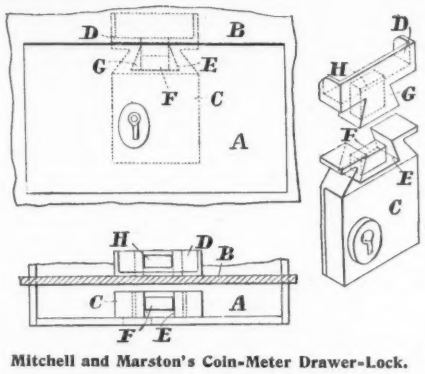
REGISTER OF PATENTS.

Coin-Meter Drawer-Locks.

MITCHELL, H., of Kentish Town, N.W., and MARSTON, A., of Willenhall.

No. 7002; March 23, 1909.

This construction of lock is more especially intended for use on the till-drawers of coin-freed prepayment gas-meters, for the purpose of providing additional security against illicit opening of the drawer. When the drawer or door is closed, the engagement of angular or dovetail parts on the lock case and the plate prevents separation of the parts, by means of a lever; and to provide means for more effectually preventing the picking of the lock by means of a false key, the key-hole, instead of being of the usual straight shape, is made with a helical twist, and the bit of the key is made with a corresponding helical twist—an arrangement which prevents the insertion of a false key with a bit of the ordinary flat shape.



Mitchell and Marston's Coin-Meter Drawer-Lock.

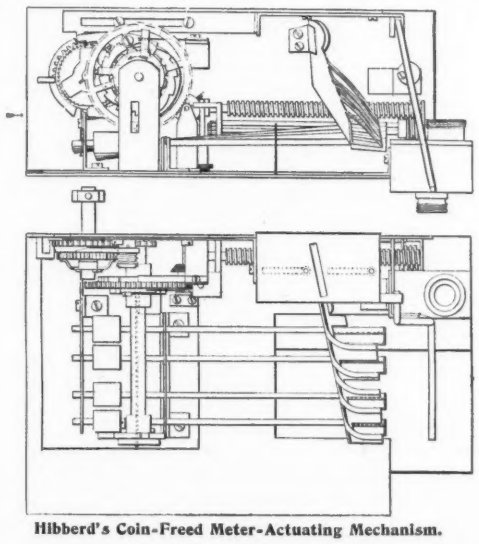
As shown, A is the till or like drawer; B, the frame in which the drawer slides; C, the lock case; and D, the locking plate. At the upper part of the case an angular or dovetail aperture or slot E is formed; and the locking plate is furnished with a corresponding angular or dovetail projection G, which enters the recess E when the drawer is shut. The locking bolt F, when the key is turned, is shot from the lock case into a recess H formed in the part G of the locking plate, and so locks the till. The engagement of the parts E and G provide effectual means for preventing the separation of the lock case from the locking plate if attempts are made to prise them apart when in engagement.

Coin-Freed Meter-Actuating Mechanism.

HIBBERD, C. E., of Victoria Street, S.W.

No. 8438; April 16, 1908.

This invention relates to meters wherein a predetermined quantity of (say) gas may be obtained by the employment of a coin operating to actuate the mechanism; and it is directed to improvements in patent No. 17,877, of 1905.



Hibberd's Coin-Freed Meter-Actuating Mechanism.

The meter is provided with a screwed spindle rotated by the hand-controlled mechanism, and a worm carrying spindle rotated by the flow of the gas—both arranged horizontally within the casing fitted to the top of the meter. The spindles and worm co-act in a manner similar to that described in the earlier patent, being supported at one end in the end plate of the casing, and at the other end in a bracket secured to the front plate of the casing near the centre. The latter end of the worm-carrying spindle carries a toothed wheel which gears through an adjustable idler with a third wheel driven directly by a worm or the like on a vertical shaft operated from the usual gas-driven mechanism. The first-mentioned toothed wheel may be replaced by one of any size so as to vary the rapidity with which the gas-valve is closed, and thus change the mechanism to suit the varying price of gas. Pivoted on the end plate of the casing, adjacent to the end of the worm-carrying spindle, is a lever adapted to be operated by the worm as it approaches the end of its spindle, and thus directly operate another lever fixed to a spindle passing through the inlet valve casing. This oscillating spindle is provided with a fork projection or the like adapted to engage and reciprocate a slide-valve for controlling the gas. This valve is arranged so that just as it reaches its closed position the projection upon the oscillating spindle engages the back of the valve and forces it positively on to its seat, and ensures a tight closure. The valve may, in addition, be pressed towards its seat by a spring. A spring is also provided, tending to open the valve so as to admit gas when the worm is moved along its spindle again by the hand-operated mechanism.

The operation of the mechanism as shown may be briefly described: Assuming all parts to be in their normal position and a coin inserted, it is guided to its corresponding coin-lever and tilts this so as to set the corresponding projection in the path of the corresponding projection on the main drive-shaft, and simultaneously tilts the pivoted bar which normally prevents the rotation of the handle and releases it. The handle is now operated to give the auxiliary drive-shaft a half-turn in the forward direction; the ratchet disc thereon moving with it and being prevented from backward rotation by one of the two oppositely disposed pawls—the other pawl riding on the periphery of the smooth washer. During the initial part of this movement of the handle, the coin slot is closed; and the horizontal part of the bent lever arm dislodges the coin from the coin lever. If a coin of greatest value had been inserted, the main drive-shaft would have been allowed to make a complete revolution for the half-turn of the auxiliary drive-shaft. If, however, the main drive-shaft is stopped at any intermediate point (depending, of course, on the value of the coin inserted), the toothed disc on the auxiliary drive-shaft is stopped; but the ratchet disc is allowed to complete its half-turn by disengaging from the pin on the toothed disc. Upon completion of the half-revolution of the handle, a V-shaped projection on the slotted disc engages the pawl riding on the periphery of the washer and forces it on to the teeth of the ratchet disc, thereby preventing its further forward movement; and simultaneously the raised portion of the ratchet disc engages the point of the opposite pawl and allows it to be forced on to the periphery of the washer. The handle is then turned backwards to its original position; reversal of its movement being now prevented by the pawl engaging the ratchet disc on the auxiliary drive-shaft.

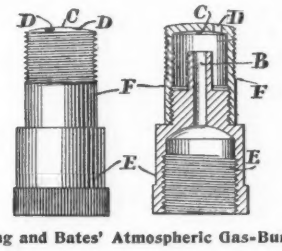
During the latter part of the movement of the handle, the coin-slot closer is removed from the slot, and the horizontal coin-ejecting arm is returned to its normal position; and, further, the oppositely disposed ratchet pawls are again reversed—one being thrown on to the periphery of the washer, and the other on to the ratchet disc. The parts are now ready for a repetition of the operation.

Atmospheric Gas-Burners.

YOUNG, W. T., of Battersea, and BATES, C., of Bowes Park.

No. 14,658; July 10, 1908.

For use with atmospheric gas-burners for lighting or heating, this device consisting of a nozzle E for screwing to the gas-fitting; a short tube B projecting from the nozzle; and a thimble F screwed to the nozzle, and having a number of small holes D in the closed end and provided with a screw-thread for attachment of the burner. The small tube B from the nozzle is so positioned that the gas flowing through it



Young and Bates' Atmospheric Gas-Burner.

strikes the end or roof C of the thimble and rebounds before passing out of the holes D in the end of the thimble F in lines parallel to the axial line of the tube B.

The pressure of gas is in this way reduced, and a steadier and more even pressure is said to be maintained—"allowing of the better admixing with the air, thereby producing a steadier light, greatly prolonging the life of the mantles, and reducing the gas consumption at least one-third."

Inverted Gas-Lamp.

HOTTON, W., of Charterhouse Buildings, E.C.

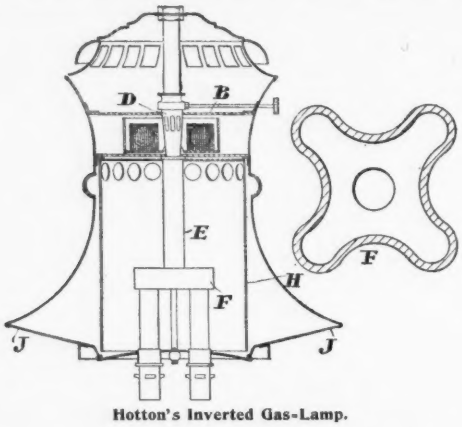
No. 14,470; July 8, 1908.

This invention has reference to incandescent gas-lamps having one or more inverted incandescent burners, each with a single conduit communicating with a mixing-chamber; the object being "to provide better means for supplying air to the burners, and also for carrying away the spent gases—thereby increasing the illuminating power of the lamp."

The illustration (p. 48) shows a lamp provided with four burners constructed according to the invention; also an enlarged inverted sectional plan of the mixing-chamber.

In the body of the lamp (near the top) a number of perforations are provided on either side, for the purpose of obtaining a supply of air

which enters the tube B fixed transversely in the interior. Fixed transversely in the centre of the tube is an injector tube D, provided with the usual regulator through which the gas is conveyed; and as air enters from either end of the tube B, it mixes with the gas at this point—the gas and air being then carried down the central tube E to the chamber F, in which both are thoroughly mixed. A screen for splitting up the air as it enters the tube B is placed around the injector tube.



Hotton's Inverted Gas-Lamp.

The mixing-chamber is provided with (four) outlets, to each of which is connected a burner. Fitting in the interior of the lamp is a cylinder H, up which the waste products from the lamp pass and escape through perforations at the top of the cylinder, so as to pass out at the bead of the lamp. In order that a supply of pure air may be passed into the globe to assist in conveying the waste products up the tube H, openings J are made around the outside edge of the lamp body, and other openings around the bottom or portion of the lamp which extends into the top of the globe when fixed in position. By this means, a current of pure air is conveyed directly to the mantles.

Wall-Supports for Gas-Meters.

DALLAS, G. A., of Hoxton, N.

No. 16,646; Aug. 7, 1908.

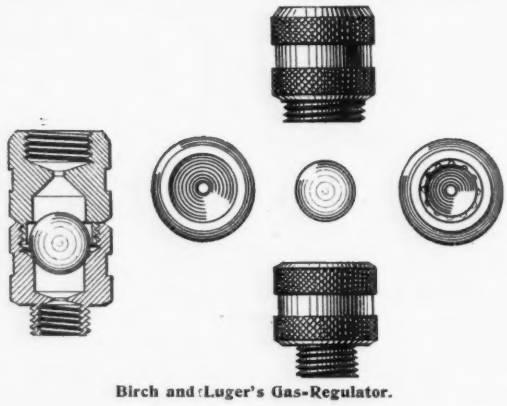
This invention comprises a portable wall-support for gas-meters, waste-water tanks, and the like—made by cutting a single piece of sheet metal and bending it at right angles at about its middle, while two parts at each side when bent overlap and are riveted together so as to give rigidity to the whole. It is on the same principle as that illustrated in the "JOURNAL" for March 16 last, p. 776.

Gas-Regulator.

BIRCH, E., and LUGER, R., of Stafford.

No. 16,656; Aug. 7, 1908.

In this invention a seating for a ball is arranged in a cylindrical body having a hollow screw at the bottom for connection to the fitting. The body is cupped to receive the ball, and has a central gas-passage up from the hollow screw. Above the seating for the ball an internal thread may be run to receive a cover or upper part having a connection to the burner fitting. In the upper part a second seating is preferably formed; and in both seatings a number of slight incisions are made of a size determined to pass a certain amount of gas. When the regulator



Birch and Luger's Gas-Regulator.

is arranged between the gas-pipe and the burner fitting, in an upright fitting, the ball is maintained against the upper seating and closes the normal opening, so that only the quantity of gas determined by the size of the incisions is passed. When the object is to maintain a constant pressure at the burner, a simple cover forming part of the connection to the burner is used. The desired pressure is then calculated to lift the ball from its seat the distance allowed by the cover of the device—thus forming a passage of the required size.

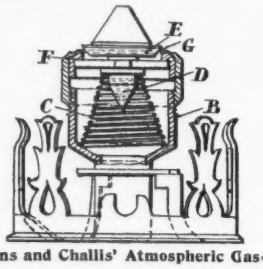
The illustration shows a section of this regulator and the various parts before they are assembled.

Atmospheric Gas-Burners.

STEPHENS, K., of Manor Park, Essex, and CHALLIS, J., of Holloway, N.

No. 21,264; Oct. 8, 1908.

The patentees propose as means for controlling the supply of combustible to gas-burners for incandescence mantles to provide a helical coil or spring through the interstices of which the mixture is constrained to pass on its way to the burner, with means for enlarging or contracting the interstices. Also by supporting the mantle-carrier from the coiled spring, the latter can be utilized as an anti-vibration device for protecting the mantle.



Stephens and Challis' Atmospheric Gas-Burner.

As shown, the bunsen tube is enlarged at its upper end to form a chamber B, on the bottom of which is seated a helical spring C conical in form so as to leave substantially the same amount of space outside the coil spring as there is inside. Its upper contracted end is closed by a plug or stem D depending from the burner nozzle plate E, and having projecting arms, which are engaged by the lip of a ring or fillet F of refractory material, forming, in conjunction with the plate E, an annular jet or orifice G. The ring is secured within a cap which screws on the mouth of the chamber B, and by means of which the spring can be more or less compressed so as to vary the area of the gas-passage, and thus control the supply of combustible to the burner and also the admixture of its constituents. The nozzle plate is surmounted by a coned boss bored centrally to receive the supporting crutch for the lamp mantle.

Manufacture of Ammonium Sulphate.

ERLENBACH, E., of Zabrze, Germany.

No. 27,878; Dec. 22, 1908. Date claimed under International Convention, Jan. 10, 1908.

In the manufacture of ammonium sulphate according to the process hitherto generally in use, the ammonia vapours resulting from the heating of ammoniacal liquors from gas-works, after they have been mixed with lime, are (the patentee points out) passed through sulphuric acid of suitable concentration, and the precipitated salt is removed either continuously or periodically. In order to obtain salt of high percentage in ammonia and of low percentage in free acid, it is necessary for the mother liquor to be as nearly neutral as possible; but when the percentage in acid decreases, the acid loses its capacity for absorbing ammonia, and the amount of ammonia in the vapours leaving the bath increases. In order to fix the ammonia contained in the escaping vapours, it has been attempted to wash the vapours with the sulphuric acid flowing to the bath—the sulphuric acid being brought into intimate contact with the escaping vapours in washing apparatus of various kinds; and in this way the washing acid becomes highly heated as the ammonia and the water from the escaping vapours are absorbed. In using acid of a concentration of (say) 60° Beaumé, temperatures of about 150° C. are produced, at which the strong acid has a highly destructive action on the lead of the apparatus, which is rapidly eaten away—this being generally observed in the usual method of manufacture of ammonium sulphate containing more than 25 per cent. of ammonia, and in which the escaping gases contain much ammonia.

The patentee claims to have found that it is possible to secure the perfect removal of the ammonia contained in the vapours and perfect preservation of the absorbing apparatus, and also a reduction to as low as 0·3 per cent,, or less, of the amount of free acid in the ammonium sulphate, if the whole of the water which can be evaporated by the heat of the reaction be not added to the whole of the acid required. Thus the acid is not diluted to a feeble acid, but only a part of it—sufficient for the absorption of the ammonia contained in the vapours; while the remainder (not so diluted) is added to the boiling bath of sulphuric acid of higher concentration.

As an example, he says: I will presume that sulphuric acid of 60° Beaumé is employed in the manufacture of the ammonium sulphate, and that the daily production of ammonium sulphate is 10,000 kilos. For this purpose, it would be necessary to use about 10,000 kilos. of sulphuric acid at 60° Beaumé. Of these 10,000 kilos., 8000 kilos. are allowed to flow constantly or periodically into the bath, and 2000 kilos. are diluted with 2400 kilos. of water—the acid and the water flowing together, and the mixture being taken into the absorption apparatus for the washing of the escaping vapours. The still strongly acid liquor leaving the absorption apparatus is allowed to flow into the bath; and the absorption apparatus is not attacked in any way, as the dilute acid, whose temperature can never exceed 109° C. (the boiling point of the acid of 30° Beaumé), does not act on lead. The strongly alkaline escaping vapours which enter the washing apparatus leave it perfectly neutral and free from ammonia; so that the vapours can be taken to the chimney without having, as hitherto, to be subjected to further cooling and washing. The temperature of the bath does not exceed 165° C.

The Wholesale Fittings Company, Ltd., of Commercial Street, E., have secured a contract for providing incandescent mantles, glassware, &c., in connection with the lighting of the Borough of Shoreditch during the ensuing twelve months.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Institution Gas-Heating Committee's Report.

SIR,—Mr. Kendrick's letter in your issue of June 29 (confirming some of his remarks made during the discussion following the reading of the Committee's report) calls for some comment.

Mr. Kendrick finds it difficult to believe that a gas of the composition stated in the report can have the calorific power found—142 calories net. One would think that the weight of scientific knowledge and experience attached to the names of the University representatives combined with the technical acumen of the others forming the Committee, would lead one to treat any figures they give with some caution, and after duly examining all available data. It is difficult to gauge the state of Mr. Kendrick's mind when he asks,

> "In order to clear up this point, it would be as well if they give us particulars of the method adopted, and the apparatus used in ascertaining the calorific value of the gas used in the experiments."

Turning to the report, we find most ample particulars. Under the sub-heading "Calorific Values," the apparatus and method are sufficiently mentioned; and taken in conjunction with the sub-heading—

> "Gas Rates: These being estimated by noting the time taken by a cubic foot of gas to pass through the meter; *correction being made by reducing the volume to 0°C., and 760 mm. pressure, dry.*

we have a really concise statement that would be difficult to make more complete. The conclusion of the paragraph—"the pressure of the gas at the meter was allowed for"—should convey to any technical reader a feeling that the decimal points of the calories were well looked after, and the units might take care of themselves. I would particularly draw Mr. Kendrick's attention to the words in italics.

It has been customary in England to state candle powers based upon a gas rate of 5 cubic feet measured at 60° *Fahr. and* 30 *inches pressure, wet.* Again I would call Mr. Kendrick's attention to the portion in italics, particularly the last word.

These conditions, I presume, Mr. Kendrick has applied to the measurement of calorific power as specified by the Gas Referees, who, in the "Tabular Numbers," provide a means of correcting gas volumes at differing temperatures, pressures, and humidities to their standards. Should this course have been followed by Mr. Kendrick, his figures are not on all-fours with those of the Committee.

Taking the tension due to the water, of 60° Fahr. temperature as 13·15 mm., and the expansion of gas to be directly as its absolute temperature, calculation shows that 1 cubic foot of gas measured at 60° Fahr. and 30 inches pressure wet would contain only 0·9273 cubic foot of gas measured at 0° C. and 760 mm. pressure dry.

Applying this correction to the figure of 142 calories complained of, we get 142 × 0·9273 = 131·6 calories per cubic foot, measured at 60° Fahr. and 30 inches pressure by a wet meter—a result which I hope will allay Mr. Kendrick's uneasiness and prove to him that his gas approaches (within 0·1 of a calorie) the heating effect of the Leeds production!

Should he still "hae doubts" as witness the extract:

> "—and if the members of the Committee will work out the theoretical value from the analysis given, they will find it considerably below that stated,"

I would ask him if he objects to any of the following figures.

In applying values for calorific power to the individual constituents of a gas, difficulty is at once met in considering the "hydrocarbons," the C_nH_m constituent. Analyses here indicate that the "hydrocarbon" portion of the gas supplied to the Committee contains approximately 52 per cent. of benzene vapour and 48 per cent. of ethylene. Taking Thomsen's values for the constituents throughout, viz.:

		Calories per c. ft. at 0°C. and 760 mm.
Hydrocarbons	52% C_6H_6 to 6 CO_2 + 3 H_2O (steam) at 903·2 48% C_2H_4 to 2 CO_2 + 2 H_2O (steam) at 396·4	659·9
Carbon monoxide	to CO_2	86·49
Hydrogen	to H_2O (steam)	73
Methane	to CO_2 + 2 H_2O (steam)	242·9

we get from the Committee's average analysis 142 calories net, viz.:

	Percentage of 1 c. ft.		Calories at 0°C. and 760 mm.
CO_2	—	..	nil
O_2	—	..	nil
Unsaturated hydrocarbon	3·9	..	25·73
CO	6·3	..	5·44
H_2	39·04	..	28·51
CH_4	33·9	..	82·36
N_2	—	..	nil
Total			142·04

Other analyses confirm the agreement between the calculated and the observed calorific powers. If there are errors in the units taken, they neutralize one another in the result.

Just why Leeds gas should be as good as Stretford gas in calorific power despite the magnitude of the "by difference" constituent, is a problem for Mr. Kendrick. One hardly likes to point out that it may be due to a similar composition of the coal gas portion; for there is an alternative reason.

If Mr. Kendrick will allow us to analyze a sample of his gas, of which he knows the calorific power by direct determination, we should be glad to provide him with the necessary bulbs for the purpose. We may then be able to decide the precise reason for his relatively low calorific power. Of course, the offer implies simultaneous publication of the details of Mr. Kendrick's determinations with those of our own.

Mr. Alex. Wilson suggested that the Committee should combine some utility with their science. Gas engineers, I feel, may equally be exhorted to combine a little science with their utility.

A. EDWARDS.

Laboratory, Corporation Gas Department,
Leeds, July 3, 1909.

SIR,—We imagine we are responsible for trying to popularize the use of reflectors with gas-fires; and as some seem to question the advantageous results obtained in the recent tests in connection with the Institution of Gas Engineers' Research Committee's report, may we explain that the reflector is not level, but of such an angle that only the radiation to the hearth inside the fender is reflected, and that parallel with the floor. The radiation to the floor outside the hearth or fender is not interfered with.

WILSONS AND MATHIESONS, LTD.

Leeds, July 2, 1909.

Mr. J. H. Brown and Vertical Retorts.

SIR,—There is absolutely nothing in Mr. Brown's letter which at all controverts my statement that no guarantee for illuminating power was ever asked for either by Mr. Brown or by his Committee subsequent to the Dessau tests, inasmuch as both the correspondence and the interview to which he refers took place before the tests were completed, and moreover had no bearing upon what took place afterwards. Mr. Brown goes on to say that—

> "On our return to Nottingham [*i.e.*, after the interview which his Chairman and he had with Mr. Körting and me], we were firmly of the opinion that it was quite useless hoping to obtain from the Vertical Retort Company any guarantees with regard to illuminating power, acceptable either to the Gas Committee or myself.
>
> "After considerable correspondence, we eventually obtained a tender for the erection of an installation. The illuminating power was specified as about 14 to 15 candle power, with the 'Carpenter' burner, whereas our minimum rate is 16 candles with the No. 1 'London' burning at the 5 cubic feet rate—the standard required by the Gas Committee."

Will you allow me to say, with reference to these paragraphs, that Mr. Körting and I were pressed by Mr. Brown and his Chairman to give some guarantee as to illuminating power. But it then seemed only reasonable that consideration of this question should be deferred until the results of the tests had become known; and this was agreed to. I am, therefore, quite at a loss to account for the opinion Mr. Brown says that he and his Chairman formed on their return to Nottingham after the interview, particularly as he subsequently wrote me (May 23) as under:—

> "You will doubtless ere this have received an intimation from Dessau as to the results we obtained in our tests with English coal. We now wait to hear from you with regard to price and conditions on which you are prepared to erect an installation at our Radford works, as suggested at our interview."

On my inquiring of Mr. Brown what guarantees he would require, his answer was, "I have talked things over with my Chairman, and he agrees with me that the best course to adopt will be for you to quote us your very lowest price without guarantee." And on the 26th of June, 1908, he wrote as follows:—

> "I think that if a close price is submitted to them [meaning his Committee], they would be willing to take the responsibility themselves and erect a plant, provided you give reasonable and ordinary guarantees with regard to maintenance, life, &c., of the retorts and machinery."

In the same letter, he further suggests that the carbonizing results should be "equivalent to those obtained by our people at Dessau;" and he winds up by saying: "I feel sure that if you would submit a really favourable quotation, our people will very seriously consider the offer." Again, on the 17th of August, he writes as follows:—

> "I have just returned from an extended visit abroad with my Chairman, and we have been more impressed than ever as to the great advantages which vertical retorts offer; and I feel sure that should your Company offer anything like reasonable terms, my Committee would be very much inclined to favourably consider the same. I should therefore be much obliged if you will be good enough to let me have your quotation at the earliest possible date, embodying therewith the general conditions and guarantees set forth in your enclosure."

The enclosure referred to was a copy of the general conditions and guarantees offered by the Dessau Company in Germany. Accordingly, a tender was eventually prepared upon these lines, and sent on the 18th of September, 1908. Mr. Brown acknowledged this on the 12th of October following, stating that—

> "We have had your tender for verticals before us; and the matter is receiving very careful consideration.
>
> "As soon as we are in a position to say anything definite to you, I will at once write you, and probably call when next I am in town."

Nothing more, however, is heard from Mr. Brown until the 18th of March of this year (or five months afterwards), when he informed me that no decision had been come to as to what type of plant he intended to adopt. Finally comes a copy of his Committee's report; and this is the first and only intimation received by the Dessau Company that their tender has not been favourably entertained.

Mr. Brown ends his letter by stating that "further explanation is obviously unnecessary." From his point of view this may be so; but from the point of view of fair play, it will be seen that further explanation was very necessary.

May I say, in conclusion, that there is nothing in the correspondence, nor was there in Mr. Brown's attitude towards myself anything which led, or could lead, me to suppose that, as stated in his Committee's report, to which I have taken exception, considerable difficulty would be experienced with the Dessau system in producing gas of a sufficiently

high illuminating power to comply with the standard to which they are now working. I should very much like to know the reasons which led them to make such a statement.

CHARLES HUNT.

17, *Victoria Street, S.W., July* 2, 1909.

Retort-House Work—Light v. Heavy Charges.

SIR,—The benefits to be derived from charging a retort full with coal are now so prominently set forth and advocated that it sounds almost like heresy to speak in favour of light charges. Anyone bold enough must, apparently, do so with bated breath.

Experiments are constantly being carried out with elaborate arrangements having for their object the more economical carbonization of coal, and beyond all doubt are productive of beneficial results. At the same time, it must be borne in mind that, in spite of the general talk of the "melting pot," transition stages, and gyratic performances, the ordinary horizontal retort still holds its own throughout the world, and, taking everything into consideration, produces what are probably the best carbonizing results. It is with respect to horizontal retorts alone that one must be eccentric enough to take exception to the general preference for heavy charges.

I have made extensive examinations and investigations with both light and heavy charges; and so far as I have been able to determine, the light charge produces the best results from a gas manufacturer's point of view. With heavy charges, it is possible to obtain superior results in the way of bye-products; but as the manufacture of gas, not of residuals, is supposed to be the primary object of a gas-works, I think it desirable to take the gas consideration as of first importance. Whether or not six-hour charges may be wisely accepted as an article of the faith, is perhaps questionable; but that such is a most convenient arrangement for the practical working of a retort-house there can be no doubt. When working conditions, and not merely laboratory results, have to be considered, this is of great importance.

The filling up of the retort with coal does not commend itself to me; and I am strongly of opinion that further investigations into the subject by others will result in the same opinion. Practical tests should be made with the same retorts and the same coal, with both forms of charging, over a sufficiently long period in order to ascertain the comparative value. Do not let it be generally recognized or taught to the younger generation that heavy charges are necessarily the correct thing for gas making—at all events, so far as the ordinary horizontal retort is concerned.

EDWARD A. HARMAN.

Huddersfield, June 29, 1909.

Checking Waste of Water by Meter.

We learn from "Engineering Record" that the effect of meters in checking waste of water is being indicated in the cities in the neighbourhood of Boston which are supplied by the Water and Sewerage Board. Under the Water-Meter Act of 1907, a certain number of meters must be installed annually by each city and town. In Somerville, the introduction of these appliances is proceeding more rapidly than the law requires; and about 37 per cent. of all the services in the city are now equipped with them. One feature of the work in this place, which is mentioned in the last report of Mr. Frank E. Merrill, a Water Commissioner, is particularly instructive. The work of installation is proceeding, so far as practicable, on the plan of a systematic metering of all buildings within a specified district at one time. Last year, for example, 132 meters were installed in a restricted district, and, as a result, it has been noticed that the water income from this area has fallen off. In other words, the metered consumers are now paying less for the water than they did on the old "flat-rate" basis, and the individual accounts kept in the water office show a very large saving over the old rates in many instances. This fact, our contemporary remarks, should go a long way towards convincing persons who have hitherto been careful in the use of water and in the maintenance of their plumbing that the introduction of a meter system will probably mean a material increase in their water bills. The practice at Somerville is to furnish all meters without expense to the property owners, and to retain ownership of them. The owner is required to pay the expense of their installation and all charges due to freezing or other damage. It is confidently expected that a result of the experience with the meter system in the district round Boston will be highly favourable to it after a few years of trial. It is perfectly true that by a careful system of inspection it is possible to reduce the waste of water temporarily in any given district, and such a system of inspection is far better than the policy of allowing things to run along in any way under "flat-rates" until the supply of water proves inadequate to the maximum demands. On the other hand, it is questionable, to say the least, if any system of inspection has the moral effect of the presence of a meter on the service of every consumer, for up to now no method of "beating" the meter records has been devised.

Increased Storage at the Ashburton Gas-Works.—A special meeting of the Ashburton Urban District Council was held last week to receive a report from the Gas Committee respecting a proposed addition to the gas-works. The Committee recommended that a gasholder with a capacity of 25,000 cubic feet should be erected, and that the offer of a site by the Hon. R. Dawson should be accepted. The report was adopted; and the Clerk was instructed to make the usual application to the Local Government Board for a loan to carry out the work.

Gas-Workers' Union and a Minimum Wage.—At a general meeting of the Midland District of the National Union of Gas Workers and General Labourers, held for the purpose of discussing the question of a six days' week and a minimum wage, the following resolutions were unanimously carried: (1) That no six days a week system can be of any service to the gas workers unless the rest day is universally Sunday; and the meeting pledges itself to fight against any floating shift being introduced by the retorts working seven days. (2) That the minimum rate of wages should be not less than 6d. per hour, but paid without reservation or disqualification to any adult worker employed.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Blackwood Gas Bill, Derwent Valley Water Board Bill, Gaslight and Coke Company Bill, Glamorgan Water Board Bill, Oldham Corporation Bill, Watford Urban District Council Bill.

Bills read the first time and referred to the Examiners: Gas Provisional Order Bill, Local Government Provisional Orders (Gas) Bill.

Scotch Bills read the first time, deemed to have been read a second time, and reported: Musselburgh Gas Order Confirmation Bill, St. Andrews Water Order Confirmation Bill.

Bill read a second time: Derwent Valley Water Board Bill.

Bills read a second time, and committed: Aldershot Gas and Water Bill, Ammanford Gas Bill, Blackwood Gas Bill, Gaslight and Coke Company Bill, Llanelly Water Bill, Oldham Corporation Bill, Pontypridd Water Bill, Watford Urban District Council Bill, West Gloucestershire Water Bill.

Bill reported, with amendments: Harrogate Gas Bill.

Bills read the third time, and passed: Musselburgh Gas Order Confirmation Bill, York Town and Blackwater Gas (Electric Lighting, &c.) Bill.

Petitions have been presented against the following Bills: Gaslight and Coke Company Bill, by the London County Council and the West Ham Corporation; Llanelly Water Bill, by the Llanelly Rural District Council; Oldham Corporation Bill, by the Rochdale Corporation; Pontypridd Water Bill, by the Neath Rural District Council; and Watford Urban District Council Bill, by the Watford Gas and Coke Company, and consumers of water in Watford supplied by the Colne Valley Water Company.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills reported, with amendments: Gas Orders Confirmation Bill (No. 2), Frimley and Farnborough District Water Bill [Lords], Gas Provisional Order Bill, Local Government Provisional Orders (Gas) Bill, South Staffordshire Water Bill [Lords], Wakefield Corporation Bill [Lords].

Bills read the third time and passed: Bungay Water Bill [Lords], Cardiff Corporation Bill, Derwent Valley Water Board Bill, Donington Water Bill [Lords], Gas Provisional Order Bill, Local Government Provisional Orders (Gas) Bill, Pontypool Gas and Water Bill [Lords], Watford Urban District Council Bill.

The Alliance and Dublin Consumers' Gas Bill, which has passed the House of Lords, will be considered to-day by a Select Committee of the House of Commons presided over by Sir Luke White; the other members being Mr. Stanier, Mr. Horniman, and Mr. Nolan.

UNOPPOSED PROVISIONAL ORDER BILLS.

The Unopposed Bills Committee of the House of Commons (Mr. CALDWELL presiding) had before them last Thursday a number of Bills to confirm Provisional Orders granted to gas undertakings for various purposes.

Birkenhead Corporation Gas.

This was an Order granted by the Local Government Board to the Birkenhead Corporation authorizing them to acquire additional lands for the purpose of extending the gas-works, and also to dispose of portions of the land they at present own and do not require for these purposes. The land proposed to be acquired is 12,214 square yards in extent; and the Order provides that the moneys derived from the sale of lands not required shall be devoted to the paying off of moneys borrowed by the Corporation for their gas undertaking. Mr. Herbert Boyce, of the Local Government Board, explained the provisions of the Order. At the local inquiry there was one party still in opposition; but he was now satisfied, and was in agreement with the Corporation. The Bill was formally passed and ordered for third reading.

A Confirmation Bill contained Orders relating to Brough and Elloughton (Yorks.), Sutton and Hooton (Cheshire), Settle (Yorks.), Langley Mill and Heanor (Derbyshire), and Long Eaton (Derbyshire).

Brough and Elloughton Gas.

This was a Provisional Order authorizing the Brough, Elloughton, and District Gas Company, Limited, to raise additional capital, and for other purposes. The amount of capital so authorized is £3000, bringing the total authorized capital of the Company up to £9000, with the usual borrowing powers.

Mr. BONNOR MAURICE, Parliamentary Agent, explained that the price fixed for gas (5s. 3d. per 1000 cubic feet) seemed rather high, but it was a small undertaking. The present standard price was 5s. 8d.; but this was nothing like the current price.

Sutton and Hooton Gas.

The Provisional Order in this case empowers the Sutton and Hooton (Cheshire) Gas Company, Limited, to construct further works for the manufacture and storage of gas, to extend their limits of supply, and raise additional capital. The extended limits of supply include the townships of Eastham and Overpool, within the rural district of Wirral (Cheshire). The amount of new capital authorized is £24,000 (subject

to the auction clauses), and the borrowing powers are regulated by a clause which prevents the borrowing of money on the old capital of the Company. For the purposes of extension, the Company are acquiring a piece of land in the township of Little Sutton.

Settle Gas.

This Company seek power to raise further capital to the extent of £4000, and to acquire 2418 square yards of additional land adjoining their existing works and adjacent to the River Ribble, in the West Riding of York. A Provisional Order for the purposes has been granted by the Board of Trade.

Langley Mill and Heanor Gas Company.

The Provisional Order in this case extends the limits of supply of the Langley and Heanor Gas Company, Limited, and empowers the Company to acquire additional lands for the storage of gas and residual products, and to raise additional capital. The limits of supply are extended to include parts of the township of Codnor-cum-Luscoe, in the urban district of Heanor, Derbyshire; parts of the township of Smalley, in the parish of Denby; the townships of Horsley and Kilbourn, in the rural district of Belper; the township of Stanley, and the parish of West Hallam in the rural district of Shardlow. The amount of additional capital is fixed at £15,000. The land to be acquired is at Cross Hill, Codnor, and in the parishes of Smalley and Morley. Clauses are inserted for the protection of the Midland Railway Company, the Derbyshire County Council, and the Great Northern Railway Company.

Long Eaton Gas.

The Order granted to the Long Eaton Gas Company provides for the transfer to the Company of the undertaking authorized by the Sandiacre Gas Order, 1905, authorizes the extension of the limits of the Company's supply, and the raising of £45,000 additional capital. The limits of supply are extended to include the parishes of Dale Abbey, Sandiacre, and Stanton-by-Dale, all in the rural district of Shardlow (Derbyshire), and part of the parish of Hopwell. Clauses are also inserted in the Order for the protection of the Derbyshire County Council, the Midland Railway Company, the Great Northern Railway Company, and the Derby Canal Company. Additional land is to be acquired in the urban district of Long Eaton, in the parish of Stapleton, Notts., and of Sandiacre, Derby.

All the above Orders were confirmed, and the Bill ordered for third reading.

Another Confirmation Bill contained Orders relating to Bideford (Devon), Bude (Cornwall), Comber (Co. Down), Compstall (Chester), and Hayfield (Derby).

Bideford Gas.

Explaining the Provisional Order authorizing the Bideford Gas Company, Limited, to construct additional gas-works and to raise additional capital,

Mr. Bonnor Maurice, Parliamentary Agent, said the Company had from time to time carried forward various sums which now amounted to £7000. The Board of Trade had suggested that £1200 of this should go to create a special purpose fund. This still left a large amount to be disposed of; but the Board of Trade had given the Company six years in which to do so. Had they ordered the sum to be disbursed forthwith, the result would have been that for a year or so the public would have paid little or nothing for gas. So they allowed six years in which the balance is to be wiped off in lowering the price of gas. The amount of new capital is £10,000.

Bude Gas.

With reference to this Order,

Mr. Bonnor Maurice said the Bude Gas Company obtained a Private Act two years ago; but they had not completed their works. They found that the original capital was not sufficient, and they therefore wanted power to raise a further £3000. The Order provided that this might be treated as original capital, and not subject to the auction clauses.

Mr. Moon (the Speaker's Counsel) said it was inconvenient that it should go into the Order as "additional" capital not subject to the auction clauses, without explanation, as it might be regarded as a precedent. It would have been better had it been treated as "further" capital. It need not be altered in this instance, but should be in any future cases.

Mr. Bonnor Maurice explained that the circumstances were so unusual in this case.

Comber Gas.

This was an Order authorizing an increase of capital of £1000, bringing the total to £3400, and the acquisition of additional lands and works.

Mr. Bonnor Maurice explained that the price fixed (5s. 9d. per 1000 cubic feet) was rather high, but they were a small Company and were subject to competition from electric light. They were, however, not likely to charge more than they were compelled to. They were in this position, that there were a number of mill-owners who were their best customers, and if these mills introduced electricity, they would, of course, lose their best consumers.

The Chairman thought with the price at 5s. 9d. they probably would lose them. He wondered if they would sell any gas at all at such a figure.

Counsel for the Board of Trade said it had been reported to them that in certain circumstances they could not possibly sell at 5s.

Mr. Moon: And I suppose people would sooner have it at 5s. 9d. than not at all?

Counsel: That is so.

Compstall Gas.

When this Order came before the Committee, considerable discussion ensued on one of the clauses. The Order provides for the construction of additional works and for the raising of £4000 of additional capital (bringing the total up to £10,000), and for supplying gas within the parish of Ludworth, Derbyshire. The clause to which objection was taken provided that, in addition to the 10 per cent. dividends that might be paid in any year, any surplus of profits remaining might be devoted to the making up to this amount of dividends that in any other year had fallen below 10 per cent.

After some argument, it was decided to adjourn the matter for the purpose of considering precedents, if any; and although the previous Orders had been passed, the whole Bill was formally adjourned until this week.

At a previous sitting of the Committee (Mr. Alfred Emmott presiding), a Bill to confirm a Provisional Order granted by the Local Government Board to the Accrington and District Gas and Water Board, authorizing them to acquire certain lands adjoining the gas-works at Great Harwood for purposes of their gas undertaking, was under consideration. The lands proposed to be taken comprise 13,121 square yards, situate within the township of Great Harwood, adjoining the existing works of the Board and lands occupied by the Great Harwood District Council. Only formal evidence was given, and the Bill was passed along for third reading.

LISBURN URBAN DISTRICT COUNCIL BILL.

This Bill came last Tuesday before the section of the Local Legislation Committee of the House of Commons presided over by Sir F. Layland-Barratt. Its object is to enable the Urban District Council to supply gas, and for this purpose to acquire the undertaking of the Gas Company, and make further provision with regard to the water supply. The Bill was unopposed. Mr. Vesey Knox, K.C., for the promoters, said Lisburn was the centre of the Irish linen trade, with a population of 12,000. In 1893 the water and markets undertakings were acquired from Sir Richard Wallace, and £46,000 spent upon them in extension and development. The markets were reproductive, there being a balance of revenue over expenditure; and the water undertaking would be also if a water-rate were imposed. At present the water was paid for by measure, which merely covered the cost. Now that the Council proposed to extend their supply outside the town, they asked for power to levy a rate. The principal purpose of the Bill was to acquire the gas-works by arbitration, for which the Engineer estimated £20,000 would be wanted. The existing charge was 3s. 4d. per 1000 cubic feet. The other object was to obtain additional powers in relation to the water undertaking. The financial clauses were of the ordinary character. The promoters proposed to use the sinking fund, instead of borrowing, and to fix the equated period. Mr. H. A. Barbour, the Chairman of the District Council, said they considered it desirable to acquire the gas undertaking and to modernize the plant. He believed this would result in a lower price being charged for gas, to the benefit of the town and the immediate neighbourhood. The clauses were then gone through and adjusted; and the Bill, as amended, was ordered to be reported.

WAKEFIELD CORPORATION BILL.

This Bill, the main purpose of which is to confer further powers upon the Wakefield Corporation in regard to their water and electricity undertakings, recently came before the Unopposed Bills Committee of the House of Commons. Mr. Sharpe (Messrs. Sharpe, Pritchard, and Co.) explained that the principal objects of the Bill were to extend the time for the construction of additional water-works and to obtain further borrowing powers for the completion of these works. At the present rate of increase in the population in Wakefield and the district, the whole of the water to be impounded in the new reservoirs would be required in fifteen years. The further borrowing powers were asked for because it was found necessary to carry the embankments and works to a greater depth; and the works had been larger than the original estimates contemplated. The first estimate, made in 1880, was £60,000; but the Corporation had had to expend £149,000—leaving an excess of £89,000. Of the works to be authorized, the total cost was approximately £150,000; and the period the Corporation were asking for repayment was 60 years. After some discussion, the Committee decided to allow the period of 60 years to stand in the Bill. Evidence having been given by the Town Clerk (Mr. Greenhalgh), the Bill was passed, and ordered to be reported to the House for third reading.

GLAMORGAN WATER BOARD BILL.

House of Commons—Tuesday, June 29.

On the Order for the third reading to-day of the Glamorgan Water Board Bill,

Mr. Keir Hardie moved the rejection of the Bill. He asked that Aberdare should not be compelled to come within the scope of the Water Board created by the Bill without its own consent, or, if that were not conceded, that at least the financial position of the Council should be so safeguarded that no financial loss would ensue.

Mr. J. Parker formally seconded the proposition.

Sir Luke White explained that the Bill was introduced in pursuance of an Act passed three years ago, giving the County Council of Glamorgan power to make inquiries and to promote a Bill of this kind. It occupied the attention of a Committee for three or four weeks, and they came unanimously to the conclusion that the measure was necessary in the interests of the districts within the area of the proposed Water Board. It would be disastrous for Glamorgan if, on the question brought forward in regard to Aberdare, the county should lose the benefits which the Bill would provide. The Committee thought it would be necessary within a short time that districts outside the area of the proposed Board should be brought within; but they did not think it right that, as was proposed by the promoters in clause 5, the

Board should have power to apply to the Local Government Board for a Provisional Order to attain that end. In the opinion of the Committee, it would be better to confine to the County Council and the Local Authorities of districts outside the Board's area of supply the power to make such an application. He did not think that, under the provisions of the clause, Aberdare could be compelled, against its wish, to form part of the Board constituted by the Bill; and he hoped that, in the interests of all concerned, the honourable member would withdraw his amendment to reject the Bill.

Mr. BURNS joined in the appeal, and pointed out that, if the amendment were carried, the effect would be to destroy a Bill the promotion of which had cost the district nearly £20,000. All the facts which had been brought forward by the honourable member for Merthyr (Mr. Keir Hardie) were fully revealed to the Committee, who gave them a fair and adequate hearing. On the broad facts, Aberdare had a superabundance of water, and practically had command of the watershed to which other communities had right of access. Glamorgan and the other communities had the right to come to Parliament to prevent one local authority monopolizing what Nature intended for all. Aberdare had not a particularly strong case for preferential treatment, and, in fact, made a profit out of water supplied to meet the requirements of the surrounding area, while lower down the valley there were communities in want of water. The claims of Aberdare could be considered at a local inquiry which the Local Government Board would hold preparatory to the granting of any Provisional Order. He therefore appealed to the honourable member to withdraw his amendment.

The amendment was by leave withdrawn, and the Bill was read the third time.

GRAVESEND AND MILTON WATER ORDER.

Local Authorities' Consent Dispensed with.

In accordance with section 4 of the Gas and Water Works Facilities Act, 1870, the Board of Trade have reported to the House of Commons their reasons for dispensing with the consent of the Gravesend Corporation and the Northfleet Urban District Council in the case of the Gravesend and Milton Water Provisional Order.

The application for the Order was made by the Gravesend and Milton Water-Works Company, who sought power to construct additional works and raise further capital not exceeding £51,000 by shares or stock, with borrowing powers not exceeding one-third of this amount. The promoters having failed to obtain the consent of the two authorities concerned, and various objections having also been lodged, a local inquiry was held on behalf of the Board of Trade. It appeared that the Gravesend Corporation did not offer any objection to the construction of the proposed works or the increased expenditure; but the Northfleet Urban District Council, who contended that the new works would not enable the promoters to supply the high ground in the southern part of their district, were opposed to the granting of the Order. Having regard, however, to the circumstances of the locality, it appeared to the Board that the works proposed would be adequate for the supply of the district for years to come. They accordingly decided to dispense with the consents of the two authorities, and allow the Order to proceed.

The remaining opposition was chiefly directed to obtaining a reduction of the existing authorized charges for the supply of water, and the insertion of a provision requiring the promoters to soften the water supplied by them. It appeared that the water was similar to that supplied in the neighbourhood by the Metropolitan Water Board and by other water companies; and the Board thought it unnecessary at the present time to insist upon the promoters incurring the heavy expenditure which would be involved in the adoption of a process for softening the water. As to the authorized charges, the Board decided to insert provisions in the Order altering the basis of charge from rack-rental to rateable value, and making such alterations in the scale as would result in some reduction in the case of the smaller houses.

Liquidation of the British Cerofirm Company, Limited.—A statutory meeting of creditors was recently held at the offices of the Liquidator (Mr. M. H. Moody) for the purpose of receiving a report upon the affairs of the Company, and deciding upon what future course should be adopted. The Liquidator stated that his investigations showed that the books had not been posted since the commencement of the Company's operations; but this work had now been carried out as far as the information available permitted. The statement issued by the Official Receiver gave among the assets the sum of £1070 as representing book debts; but the Committee's investigations revealed under this head a sum of about £2150 as owing. The plant and machinery at the works at Bromley were offered for sale by the Sheriff of Kent; but less than £250 was realized for the portion sold. One of the Directors had, it was alleged, sold the whole of the machinery to Mr. Morgan Brown (a gentleman who had been connected with the undertaking from the commencement) for £350, and had sublet the Company's premises to the same person. According to the minutes of a Board meeting held in November, 1908, the stock-in-trade, freehold premises, &c., were stated to be valued at £6408; and as the price of the freehold premises (£1500) was included in this sum, it followed that the stock, plant, &c., were worth £5000. Nevertheless, the Sheriff's sale seemed to have realized only £250; Mr. Morgan Brown paying £350 for the residue. This and some other matters required probing to the bottom. After discussion, a resolution was unanimously passed whereby the creditors present or represented agreed to the Liquidator pressing his claims against the various persons apparently liable to the Company for sundry amounts; the creditors agreeing to indemnify the Liquidator against any expenses he might incur to the extent of 5 per cent. on their respective claims. In answer to a creditor, the Liquidator said he did not think there was much prospect of the Company being resuscitated, though it was a fact that the Official Receiver had granted a licence to a gentleman to work the patents and make use of the secret process which was an important feature of the business.

LEGAL INTELLIGENCE.

ASSESSMENT OF THE PETERBOROUGH GAS-WORKS.

Company's Appeal Dismissed.

At the Peterborough Quarter Sessions last Thursday—Mr. E. P. MONCKTON, the Recorder of Northampton, presiding—decision was given in the appeal by the Peterborough Gas Company against the assessment of their property in the parish of Peterborough Within. The earlier proceedings were reported in the "JOURNAL" for May 25 (p. 533) and June 1 (p. 591).

The CHAIRMAN said the Court had been through three very trying days. The hearing of the appeal had taken a very long time—too long, he thought; for the evidence might have been condensed very considerably. The Justices were unanimous in their decision, and it was in favour of the respondents. The appeal would be dismissed with costs. They found that the rateable value—in the first instance £4500, and afterwards reduced by the Assessment Committee to £4360—was a fair one. The Gas Company's valuation of £2685 was, they thought, ridiculous. They had gone through the case very carefully, had had several conferences, and this was their decision.

Mr. MORRES NICKALLS (for the Company) asked if the Justices would state as a fact what the finding was as to the terms in regard to lamp-posts.

The CHAIRMAN said if they were forced into giving their findings they would have to base their decisions on matters of fact and not on matters of law. It had been a very long case, and he considered the ends of the Court were met by the decision given. The question asked was a point which should have been raised at the time they were arguing the matter, and doubtless the Justices would have consented to give their finding on that particular point.

Mr. NICKALLS said he was instructed to ask for the Court's decision on the point. Whether they proceeded with it was another matter.

The CHAIRMAN: I do not see that we are called upon to do it.

Mr. NICKALLS: Did you find against us on that point?

The CHAIRMAN: I do not think we are called upon to state a case.

Mr. NICKALLS: It is a point which has never been decided before, and it is a very important one.

The CHAIRMAN: The request should have been made when the point was raised during the hearing of the case.

Mr. NICKALLS: I understood that it was raised, and that a finding on it would be given to-day.

The CHAIRMAN: The matter was not put before us in that form. If you wished to argue a point of law, it should have been done at the time; and that is when you or Mr. Ryde should have done it. I do not think we are called upon to listen to it now.

Mr. H. L. WARD (for the Assessment Committee) concurred.

The CHAIRMAN (to Mr. Nickalls): You will have to *mandamus* us if you want it.

EMBEZZLEMENT CHARGE AGAINST A GAS MANAGER.

Prosecution at Margate.

At the Margate Police Court last Thursday, Mr. Frank A. Winstanley, Engineer and Manager to the Isle of Thanet Gas Company, was charged on a warrant with embezzling, between June 19 and 26, a postal order value 7s. 6d., belonging to his employers.

Mr. GILL DAVIES appeared for the defence.

Without any preliminary opening of the case, the following evidence was adduced.

Mr. *Thomas C. Fuller*, Secretary to the Company, said: I know the prisoner very well as the Manager and Engineer of the works department of the Isle of Thanet Gas Company, and know that he had been in their employ just upon four years. His salary is £360 per annum. Letters delivered by the postman at the Company's offices are put in the box at the main door of the works, leading into the offices from Addington Street. The letter-box is kept locked; and there are to it three keys. One is kept by Mr. Hobbs, coke and rental clerk; another, which I never use, is in my own charge; and the third is held by Mr. Winstanley. When the box is opened in the morning by Hobbs, all letters are sorted. Those which are for the Secretary are sent to my office in the board-room; those which refer to the other departments are sent there; and those for the works department go across to the prisoner's office. That is the general routine.

Cross-examined by Mr. DAVIES: Mr. Winstanley was supplied with a key of the letter-box; and as a result he was entitled to open the box at any time.

Mr. DAVIES: It was never explained to him that he must not open the box in the evening?

Witness: Certainly not.

As Manager of the works, it would be no unusual thing for him to open the box in order to see what correspondence had arrived at the works?—Quite so.

If, in what he considered to be the performance of his duties, he opened correspondence in the evening, or on Sundays, you would not think it improper?—No.

Chief-Constable *Appleyard* said: On June 17 last, I received a communication from the Directors of the Isle of Thanet Gas Company, in consequence of which I sent a letter through the post addressed to the Company, Addington Street, Margate, on June 19. The letter contained a fictitious account, made out on one of the account forms of the Company, and purported to be sent by Mrs. Neve, No. 17, Hengist Avenue, dated June 3, and made out for 10 cwt. of coarse asphalt, 7s. 6d. I also enclosed a postal order for 7s. 6d., issued from, and obtained at, the Upper Approach Road branch post office on June 19. It was numbered 12H 059814; and I had it made payable at the

General Post Office, Margate. The name was left blank. I produce the counterfoil; and I may add that I saw the letter posted. On the Wednesday following, June 23, the Postmaster at Margate produced to me the self-same order for 7s. 6d.

Cross-examined by Mr. DAVIES: I am unable to tell the Bench any relations that may have existed or do exist between Mr. Winstanley and the Company.

Constance Jennie Morgan, barmaid, employed at the Nayland Rock Hotel, Margate, said: I know the prisoner as an occasional customer at the hotel. Between June 16 and 22, I remember receiving from Mr. Winstanley, over the bar, a postal order for 7s. 6d., which I changed for him. That was the first and only postal order I had ever taken of him. I paid the postal order in question in with my takings the next morning.

Cross-examined: It was customary to exchange postal orders for customers she knew.

R. K. Kemp, overseer at the Margate General Post Office, produced postal order 12H 059814, which had been paid into the general office by the London and County Bank.

The CHIEF-CONSTABLE, at this stage of the proceedings, intimated that he was unable to carry the case further that day. It was incomplete as it was; and he asked that there should be a remand.

Mr. DAVIES said, having regard to the extremely painful position in which his client was placed, and out of consideration, not for the man himself, but his wife, to whom the suspense would be most trying, and reserving at the moment anything he might have to say on behalf of the accused, he did ask the Bench to hear and complete the case that day, so as to put defendant on his trial and finish with it. It was scarcely necessary for him to point out how acutely accused must feel his position, and that his appearance before the Bench that morning was an extremely painful ordeal, the disgrace of which must be a very heavy punishment in itself. He was willing to assist the prosecution as far as he could, either as to the admissibility of the evidence they could not obtain that day, or in any way possible; and he did urge that, under all the circumstances, the accused should be put upon his trial that day.

The CHIEF-CONSTABLE said he desired a remand because the case was not complete. He must call other evidence in this case, which was not then available; and, besides, there were three other charges to be preferred.

The CHAIRMAN (Mr. F. J. Bobby) announced that the prisoner would be remanded till next Friday.

Mr. DAVIES applied for bail.

The CHAIRMAN: Bail will be granted, prisoner himself in £100 and two sureties of £100 each.

Mr. DAVIES: Cannot the bail possibly be reduced to two sureties of £50 each?

The CHAIRMAN: The Bench decline to alter their decision.

ADAPTABILITY OF LAND FOR A RESERVOIR.

Questioning an Arbitrator's Award.

In the King's Bench Division of the High Court of Justice last Thursday, Mr. Justice A. T. Lawrence had before him a special case stated by Mr. C. R. Fenwick, of Leeds, who was Arbitrator in a dispute between the Penrith Urban District Council and Mr. Brownrigg Pattinson as to the value of certain land required by the Council for the construction of a reservoir. The case raised the question whether the Arbitrator was entitled to award compensation in respect of what was known as the special adaptability of the land for the purpose intended; and the point was whether compensation could be given for such special adaptability when there was only one person in the market, and that person was the Council, who had compulsory powers. The facts as stated by Mr. Sanderson, K.C., who, with Mr. Compston, appeared for the Council, were as follows: Mr. Pattinson claimed in respect of 13½ acres of land near the Hayeswater Lake, and also put in a claim for an easement; but nothing arose upon the latter point. The Council obtained compulsory powers under an Act of 1907 to acquire the land, and an arbitration took place, resulting in the Arbitrator awarding £1822 if he took into consideration the special adaptability, and £312 if there was none—the land having agricultural value only. The land was required for heightening the lake, which was about 32 acres in extent, with a watershed of about 727 acres. It had a capacity of a million gallons daily; but 300,000 gallons had to go down a stream. The lake was suitable for a reservoir, being surrounded by hills except on the side near Penrith. It was moorland, and worthless except for reservoir purposes. There being only one purchaser, the Court could not give the larger amount. Counsel said the finding of the Arbitrator was as follows: "I find that the 12·58 acres of land belonging to the claimant comprised and described in the notice to treat with him in connection with the land of other adjoining owners have a special value by reason of their special adaptability and suitability for converting Hayeswater (a natural lake) into a storage reservoir of largely-increased capacity; and that such special value at the date of the passing of the Special Act existed for other possible purchasers, I have based my award accordingly." The Arbitrator then said that if the Court should be of the opinion that the claimant was entitled to compensation on the basis of his finding, he awarded him £1822; but if the Court should decide that the claimant was not entitled to compensation on that basis, he awarded him the sum of £312. His Lordship pointed out that the Arbitrator had not stated a case but arrived at a conclusion. Mr. Sanderson said they were bound to come to the Court; and he asked that the case might be put back. His Lordship said he could not do that. Mr. M'Coll, K.C., who, with Mr. Mansfield, represented Mr. Pattinson, said this was a rule to set aside an award, and not to argue the case. After further argument, his Lordship, without calling upon Mr. M'Coll, found that Mr. Pattinson was entitled to £1822 and costs. He held that the award was correct as it stood in the larger amount; and he said he could not do otherwise than take it as it stood. The position was unarguable.

AN ACTION AS TO LIABILITY FOR A GAS EXPLOSION.

Unsuccessful Claim against the Alliance and Dublin Consumers' Gas Company.

At the beginning of November, 1907, a serious gas explosion took place on the premises of Messrs. Forrest and Sons, drapers, of Grafton Street, Dublin (as recorded in the "JOURNAL" at the time—p. 509), by which damage estimated to amount to thousands of pounds was done, and serious injury was caused to a domestic servant. In due course, Messrs. Forrest and Sons took action against the Alliance and Dublin Consumers' Gas Company, with the object of making them liable for the results of the explosion; and last month the case came before Mr. Justice Andrews and a Special Jury in the Irish Probate Court. We were then able to announce the finding of the Jury, that the explosion was not caused by any negligence on the part of the Gas Company's servants, and that a verdict was entered for the defendants. Since then, however, we have been favoured by Mr. Francis T. Cotton, the Secretary and Manager of the Gas Company, with a transcript of the Judge's summing up, in which the full facts of the case are set forth; and in view of the importance of the case to gas companies generally, it has been thought well to reproduce this almost *in extenso*. The following questions were left to the Jury, who answered them all in the negative. (1) Was Joseph Williams, while he was disconnecting the cooking-stoves and the gas-pipes and shutting off at the meter the supply of gas to those stoves, doing that work with the defendants' authority as their servant? (2) Was there negligence on his part in the performance of that work? (3) If so, was the explosion of gas caused by such negligence on his part?

Mr. JUSTICE ANDREWS (addressing the Jury) said: Gentlemen, as you are aware, the nature of this action is that Messrs. Forrest and Sons, the plaintiffs, seek to recover against the Alliance and Dublin Consumers' Gas Company damages for the serious results of the explosion of gas which took place on the plaintiffs' premises on the 2nd of November, 1907; and the ground upon which they claim to make the Gas Company responsible for the injury sustained through the explosion is that there was negligence on the part of the Company, or upon the part of their servants for whom they were responsible, by reason of which the explosion which caused the injury occurred. Now you see that raises the first question which has been very much discussed in this case; and it is one of three questions which you will have to determine, because I think to avoid the risk of any reinvestigation of this before a Jury it will be desirable to ask you to answer each of the questions which I put to you even though some of them be afterwards found to be unnecessary.

Accordingly, the first question which lies at the very foundation of the defendants' liability is: Was the negligence which is alleged to have existed negligence upon the part of a person who was at the time acting as the servant of the defendants, the Gas Company? If he was, and if there was negligence, the plaintiffs would be entitled to sustain their case. If he was not, of course there would be an end of it. I would call your attention somewhat more particularly to these matters afterwards; but it may be convenient to give you a general view of what the course of the consideration will be before I go into more detail.

The next question I will ask you to consider and determine, irrespective of any opinion you form upon the first question in respect of which it is contended that, although Joseph Williams, who is the man who is alleged to have been negligent on the occasion in question was no doubt at the time a servant of the Gas Company, it is contended by the defendants that he was not, on the work in respect of which negligence is alleged to have been committed by him, acting as their servant (as such) but acting at the instance of a person whom they did not authorize in any shape or form to do the work that this man did. And on the other hand it is contended that you ought to regard him under the circumstances when doing this particular work as having been acting on behalf of the defendants, the Gas Company, as their servant, and therefore being in the position of making them responsible for the negligence in the doing of the work if negligence it is.

Now the next question will be one of the most important questions in the case, and one which has been elaborated at great length by Counsel on both sides, and ably discussed on both sides. Was, in point of fact, Williams in doing the particular work in question, guilty of negligence? The particular work you have quite accurately before your minds. It was the disconnection of some gas-cooking stoves from the gas-pipes, and the shutting off of the meter which supplied the gas that was to be used by the stoves. Now what negligence consists of it is right to bear in mind; and the legal view taken of negligence differs from the common-sense view taken both in respect of the aspect and the manner of the negligence used. It must always be estimated by a Jury in regard to the particular circumstances of the particular case whether a certain action is negligent or not. It is negligent to abstain from doing in particular circumstances that which a reasonably careful man would under the circumstances in the judgment of the Jury do—take reasonable precautions for the purpose of preventing any accident or damage. Or it would be negligent if there is the omission to do, in the discharge of any particular duty or the execution of any particular work, something which in the judgment of the Jury a reasonably cautious and prudent man would do in the particular circumstances. And if these particular circumstances are circumstances which in the judgment of the Jury imposed upon the person who is doing the work the obligation of taking much care, he should take much care; and that is why I put to you that in estimating whether or not there is negligence you must not consider it as an abstract question, but apply your minds to it as it refers to a particular work and particular circumstances which existed at the time, as existing circumstances under which the work has been done.

Now it has been stated as absolutely incontrovertible that the escape

of gas is a dangerous thing, and anything which is done to prevent an escape of gas ought to be done with due care, so as to secure that the danger shall not subsist. Now although there may be, in the judgment of the Jury, negligence upon the part of the person who is doing a particular work for which we must assume for this purpose that his employers would be responsible, it may be that still his employers may not be responsible for the consequences of that negligence. Because if they themselves—through any person for whose acts they were accountable, and by whose acts they would be responsible—did directly contribute to the injury which is complained of by negligence upon his part, then they were in the condition of being as it were both directly to blame in connection with the work which was being done and had been done. The law is that defendants should not be held responsible, even if there was what you may consider an absence of due precaution on their part that, if it stood alone and independent of other circumstances, would constitute negligence in a matter of this kind.

Now that being the general aspect of the case, I will have to refer you as briefly as I can to the way the evidence stands—invite your attention to what appears to me the most material portions, and leave to you only that which is material to study for yourselves. We come to consider what is the position of the parties. At the time that preceded the occurrence upon Nov. 2, 1907 (the date of the explosion), there had been entered into between the Messrs. Forrest and Sons, the plaintiffs, and the Gas Company the defendants, three contracts which we may regard as one. Among other matters which Messrs. Forrests were getting done to their premises in Grafton Street and to a certain extent round at the back in Wicklow Street, there were a considerable number of improvements and renovations in progress. We have it that Mr. Ashley, as architect, was discharging an architect's duty in respect of, I believe, such of the gas-fittings as had been contracted for by the Gas Company under the contracts. Now three stoves were to be erected, and they were to be supplied from a meter which was to be a hired meter and from which it was necessary to have a connecting pipe. The hiring agreement did not provide for what was to occur at the termination of the hiring. With reference to these cookers, they would remain (notwithstanding the hiring agreement) the property of the Gas Company. The user of them would be what Messrs. Forrests would be entitled to; the property in them would remain in the Gas Company. But if the occasion arose either before or after the expiration of the actual period of time according to the agreements in this case of replacing these stoves, the result then would be that there would be upon the premises of Messrs. Forrests these gas-cookers which would not belong to them, but which would belong to the Gas Company. The Gas Company in that state of things would be entitled to remove them; and in that state of things Messrs. Forrests would be entitled perhaps to remove them, if they regarded their premises as encumbered by these gas-stoves, the hiring of which had ceased and which they did not wish to retain. But if Messrs. Forrests did (as they do not appear to have done in any shape or form) claim the right to remove or give instructions that certain work should be done for the purpose of removal, the other aspect of the case would be: Were the Gas Company entitled to call upon Messrs. Forrests to remove the stoves? Now Messrs. Forrests no doubt might have been entitled to call upon the Gas Company to take the stoves away. But if so, the persons whom they would have called upon to take them away would have been persons authorized by the Gas Company to receive their intimation or request; and it would not have been a legitimate mode of requiring the Gas Company to take them away by making a communication of that kind to a person who was not in authority at the Gas Office—a mere gas-fitter. He would be the person who was to do the work for the Gas Company—not the person who was to enter into contracts for or on behalf of the Gas Company, or to originate work which could be originated if they were properly applied to for the purpose.

The reasonableness of this will be apparent at once if you see a different position of things. If a request of the kind were made to a simple fitter, as Williams was upon the occasion, he would have no opportunity then of supplying himself with all that was necessary for the purpose of giving effect to that which he was called upon to do with perfect safety—because the request was that the thing should be done at once, and after his experiencing some hesitation and it having been insisted upon by Mr. Thackaberry acting on behalf of Messrs. Forrests, he proceeded, and he said he proceeded to do it under circumstances which were unfavourable. If the Gas Company had been required either by their responsible officer or others in any more formal way to do the work they would have had an opportunity of giving such directions as they thought fit to their authorized workmen, the authorized officials, to take care that it was done in the way in which it ought to be done, and to provide them with all requisites that might be necessary to give effect to that which they would be bound to give effect to—the proper and reasonable precautions being exercised which it would be right should be exercised for the purpose of preventing the execution of the work from running the risk of being incomplete.

Now I have ruled that there was no contract between Messrs. Forrests and the Gas Company for the removal of the cookers which would have caused the Gas Company to be responsible persons for the purpose of giving effect to the work. I have ruled that no such contract was comprised in, or implied from, the hiring agreement that has been put in evidence; and I also ruled that there was no evidence to sustain the existence of any such contract as a contract outside and independent of the agreement. But the reason that I refer to the other matters is that that does not exhaust the case; and it is for this purpose that I call your attention to the fact that under particular circumstances—namely, the cookers remaining the property of the Gas Company—there would be the right on the part of Messrs. Forrests to call on them to be removed, and on the part of the Gas Company to call upon them to be removed.

The matters which preceded this 2nd of November I need not weary you by going over again—a general reference is sufficient. A great deal of the renovation and improvement work was going on, including a very considerable amount of gas-fitting work; and in that state of things a communication took place upon the 1st of November which I call your attention to, in Thackaberry's evidence and the evidence of Redmond and Williams. There is other evidence in the case which I will be obliged to call your attention to; but it would rather appear to me that the most important evidence of the case is to be found in the testimony of these three—Thackaberry, Redmond, and Williams. I do not think it necessary nor do I intend to deal with them with anything like minuteness although it was necessary we should have a great deal of evidence, for the purpose of giving the whole history of the case, and showing you for instance what the different departments were, how the basement was circumstanced, how it was that it was lighted not by gas but by electricity, what was the condition of the doors, and all these matters which were so clearly explained by them in the matter.

I may pass on to refer to the evidence of the very intelligent gentleman who spoke of the accuracy of the maps and explained the basement, the position in which the meters were, the communicating pipes between the meters and the gas-stoves, and the position in which the gas-stoves were, and who pointed out the various doors and portions of passages, shops, and otherwise. He indicated very clearly and very satisfactorily the geography of the premises. Mr. Murray having given his evidence, the next evidence that was given in the case was the evidence of Mr. Thackaberry, which I must refer to. It does not appear from the evidence that there had been any antecedent communication between Messrs. Forrests and the Gas Company with reference to the removal of these cookers. The intimation that was given to remove them does not appear to have been given before. But what is material to bear in mind on this part of the case is that the first communication that they were to be removed seems to have come from Mr. Thackaberry on the 1st of November. Understand on that date among the improvements and changes which were taking place in Messrs. Forrests' premises were certain improvements in connection with the inside part of the establishment, and the place in which these cookers were and had been used practically from the middle of the preceding January. That had been called throughout the evidence the old kitchen and the old place; and there was another place referred to as the new kitchen. This new kitchen was designed by the architect; and under the contract in respect of which the work was carried out, it was carried out so that what could be otherwise done by gas might be done as we all understand by the ordinary kitchen range. Towards the end of October, as Mr. Thackaberry seems to have thought, Messrs. Forrests elected to cease using the gas cookers, and resorted to the use of the new kitchen range which was practically complete. Different persons who were acting on behalf of the defendants (and among them Williams) were doing the different gas-fitting work which had not then been completed; and it was gas-fitting work that Williams came on the premises upon that particular occasion to do. It is not shown, as I mentioned before, that the particular work which the Gas Company had the persons there for doing, in any shape or form included the removal of the cookers in question.

There is a slight discrepancy between the evidence of Mr. Thackaberry and the evidence of Williams. Mr. Thackaberry gave to the best of his opinion the hour at which the explosion occurred. What he says did occur was this (and it becomes important to consider it), that on the morning in question he spoke to Williams, and told him to disconnect the gas cookers, as the kitchen range was going to be used. This was between the hours of 11 and 12 o'clock of the 1st of November—a Friday; and he believes that between 3 and 4 o'clock the same day he went to the kitchen in which the cookers were, and found there Mr. Sugg and Williams. Mr. Sugg pointed out to him that the cookers had been disconnected, and he noticed the large cookers disconnected. They were moved out from the wall, having been close to the wall before. He noticed that the small cooker had been removed, and he said that after the conversation took place which has been referred to on both sides—as to whether they were going to have other gas cookers in the other place—he indicated that it was in contemplation but not absolutely decided upon. He was cross-examined by Mr. Campbell, first, upon the question as to whether when he saw the disconnection did he give any instruction or direction with reference to it. Mr. Campbell referred to the night watchman, Redmond, who had charge of the place; and he said he did not recollect giving him instructions or directions on the subject, and went on to state that Mr. Ashley was directed in connection with the works, but that it did not include the operation of removing the cookers in question. Now he said further that he had never seen the specification for the work the Gas Company were to do—that the architects attended to this themselves; and he then told us that the night porter had as part of his duty to turn the gas out, not only in the place where the meters were, but as Redmond afterwards told us where there were other taps to supply gas in the building. He also said, for the matter of the firm's defence, that sufficient precaution had been taken.

So we have from each party what precaution had been used. He said further on that he had no recollection that Sugg or Williams suggested to him a warning afterwards. The next witness, Mary Murphy, told about the night before the explosion. She was the kitchen maid and was it seems the person to get up in the morning to look after the arrangements of the kitchen—light the fires and so on. She told where she slept and the position in which the housekeeper's room was below hers; and she said that she had nothing to do with the turning off or on of the gas—that as far as her department was concerned everything in her portion of the premises in which she was concerned appeared to be in good order and nothing astray. She then stated that on the 1st of November she had used pretty nearly for the last time the cookers which upon that occasion had not been disconnected; and the very last use would appear to have been when certain cooking was done and finished at the hour of about 2 o'clock. After that the disconnection would appear to have taken place. She then gave her account with regard to what occurred—about having proceeded to smell the gas and having gone to her superior, the housekeeper, with reference to it; how she and the housekeeper carefully went through the premises and looked at the gas-caps; and that they were all turned on. After she had communicated with Redmond, she said she proceeded downstairs, having the light of the lantern. She went into the kitchen where the range was; left the lantern, and proceeded through the kitchen where the cookers had been; and then she described (as a part of what had been done) the making a change from one kitchen to the other. When, after having been all through the coal hole and the passages, she came near and opened the door of the new kitchen where

the cookers were, she described the outrush of gas as the explosion took place. Some of you seemed to think, perhaps, it was an extraordinary thing, her description that it took her off her feet; and when the gas having escaped in that way would only go through the door she had opened, get into the other kitchen where the light of the lantern was, where the fire was lighted, and in the way she described that that is how the explosion actually took place.

Now I come to Mrs. Stewart, the housekeeper. She described what the kitchen maid had done; what she knew of the gas on the morning in question, and how it occurred to her that there were some of the taps open in the passages; how she got up and examined them with the greatest activity, and seemed to have her suspicions aroused to see them open. She said Redmond's duty was to attend to the lights in the passages as well as to the other duties in connection with the meters and matters of that kind; and she said that it was also his duty to attend to the gas-meters. After she went her round of inspection on the night of Nov. 1 (and nothing had attracted her attention), Redmond would have gone after her. She said she remembered the last cookers going out of use. Before the explosion, on the 1st of November, she said she saw a man at the cookers—that man was Williams. She had seen him; and she knew he was one of the Gas Company's men. He was with some of the men at the other gas-fitting work that had been referred to. She said she examined all the different places on the night of the 2nd, and then closed and secured the doors and left them all right; and it was not suggested for a moment that Williams was not there and at the time was in the employ of the Gas Company. But it is a different thing if he was actually doing it either for or at the instance of Mr. Thackaberry under circumstances which would not, according to the view of the Gas Company, make them responsible.

The next witness is a witness whose evidence I must ask you to thoroughly consider, because he is a very important witness in the case, Thomas Redmond himself. Now after describing that he had been for six years acting in the capacity of porter at Messrs. Forrests' premises, in which he lived, he tells us that at night his first duty was that about 11 o'clock he went round about the Grafton Street side of the premises, turned off all the gas jets that were along the walls on the different floors (third, fourth, and fifth floors) towards the front of the house; and he states that then his duty was to go down to the basement. On this night had arrived at about a quarter past 11; and the first person apparently he met was the housekeeper. He then went down to the basement, which has a certain amount of electric light; and his evidence is that he "knocked off" the three electric meters and then turned off the three gas-meters. On the Friday night he turned off the three meters in the basement as usual and locked the door. It then appears that he went to the top of the Wicklow Street side of the premises, and left the keys with Mr. Simpson, who is the custodian of them after Redmond, who had charge of them, delivered them up to him. You see that is practically his description of everything he did. He repeats he turned off the electric light first. But after stating that that was the first thing he did, he goes on to say that the next electric lights are in the area. He says that he had a candle alight, not a lamp. He then goes on to say that after he turned off the electric meters he went to the gas-meters. Williams had told him that he was working at the cookers and about to disconnect. Now he says at this part of his evidence that that was all the information he had. I do not think there is the least necessity to impute to a witness who uses at one time language not the language exactly he uses at another that he has perjured himself. It is a slight test—a matter which should not be concluded unless there is more satisfactory proof of it. But the witness may not be regarded as a deliberately untruthful witness if he gives sometimes an imperfect account, sometimes a contradictory account at one part of his evidence than at another. It is necessary, without imputing perjury, to decide in every case, and not the least in a case of this kind, upon the extent to which you should rely upon the accuracy of the testimony given. And on this point he says that was all the instruction he had. Now he goes on to say that when the gas was on the cooker the handle was hanging straight down, and apparently that would be the normal state of things and everybody seems to say that would be so. It is a curious thing if this man, though there for six years and entrusted with the duty of turning off the gas throughout the place, would have any doubt (our attention was called to it irrespective of the position of the handle) whether the gas was off or on. He says with this cooker, when the gas was on, the handle hung straight down. He then says (and this is in reference to the particular occasion in question) he shut it off. He indicated upon the model what he did.

The case for the plaintiffs is that, in point of fact, he was turning on the gas, and I think that there is no doubt that that was the immediate cause of the gas escaping and going away up through a number of apertures. He understood that the disconnection had taken place, though they say not; and that this man Redmond should be blamed for it because they say that he was not doing what was his natural duty—turning the thing off, but instead he was turning it on. By reason of what they say was the fault of Williams he was turning it on, and they call attention to that which has been considered in the rest of the case that he did not even neglect to warn him on the occasion in question of the exceptional stiffness in the turning of the plug, which Williams says was tightened-up, and which the other witness corroborated was so tightened-up on the occasion of the accident. But what he does say is that Williams had been working on the cookers, and it was time to disconnect them. But it does not appear that he did. He himself swears later on with reference to the mode in which he acted when he was performing this operation of turning off the gas. He says it was he who always pulled the handle towards him; and he says that the practice was that the handle remained on the stock. The second thing he acts upon is that there it was hanging, and that the way it hung down indicated to him that the gas was on and that he turned it up when it indicated that the gas was off. He went on to say that the handle was stiff—sufficiently stiff to remain there. He says there was no previous escape or mistake; and he said that when he was turning the handle on it clicked against the pipe, and (as far as he could see from the dark place when they made the experiments) that would be in the nature of pulling the handle towards him. This part of the case is accepted on both sides, that he did something that turned on the gas. He said that on the Friday night no more force was required to close the tap than upon any previous night; and he said afterwards, in connection with the doors, that a person could not have gone in there and interfered with the premises—he having locked the passage doors after inspecting them in discharge of what no doubt was his duty.

He then says further on towards the close of his evidence: On Friday Williams said to him of all the jobs he ever was in this was the worst; that he was told on Thursday to do nothing although he was putting the fittings in the ladies' sitting room, and then that he was called away on Friday to disconnect the cookers and that he said "I believe that Mr. Thackaberry and Mr. Sugg were in the cooker kitchen." Now he goes on to say that between three and four o'clock Williams mentioned to him something like that the meter was off or the connection was cut off, and it was nothing more. What had he said before? It was that all the information he got was that something had occurred which, as he reported in his evidence, was one of two things—either that the meter was off or that the connection was cut off, and that he could see both were. Now he was very stiffly cross-examined with reference to his evidence; and the portion of it which bears upon this matter I will now refer to. After he said that he could not exactly say what it was that Williams said to him, he repeats that what he said was either that the meter was off or that he had cut the supply off the meter. "He said something to me about the meter;" and then he was asked with reference to what else could have been said, and he was asked about the labels. Now in Mr. Thackaberry's evidence early in the case he indicated that the cookers had labels on them. He is asked about the labels; and he says "I can't remember seeing the labels, but think the labels were there." That is the expression. He says that after the explosion all the meters had labels on them. "I only noticed them there, and then I could not say that they were there before the explosion," and the word brass was used. He said that this brought to his recollection what apparently had not been present to his mind when he was stating this other evidence, because when the word brass was mentioned he stated "I saw the brass labels on the meters. I remember now that there were brass labels on before the explosion." The labels were there to show for what purpose each meter was used—one for domestic supply, one for the stoves, one for the cookers; and he did not remember this till hearing about the brass on the handle. "The meter has brass on the handle. What Williams told me was about the cooker meters. When I turned on the meter, I remembered what Williams had told me. I had forgotten what he told me." And then he was asked what was the truth about that. He said, "The truth is I had forgotten what he told me;" and then he said immediately after that "He told me he had done something to the meters." He was cross-questioned upon it. "What could he have told you except that he had turned them off?" And then his answer was "He told me that the meter was off or that the connection was cut off. He may have told me that the meter was turned off." He then stated further, "I could not really understand whether he said the meter was off or the connections were cut off; it went out of my head; it did not come down to me that particular." Then Doherty and Williams, who were afterwards witnesses in the case, were directed to stand up, and he was asked to look at the men and was asked whether Williams in Doherty's presence had told him he had turned off the meter and disconnected the meter; and he then said "I could not swear, I won't swear he did not." And he then said again, "He told me he had been working at the cooker, and was about to disconnect it." Towards the very close of the cross-examination he was asked again what he did when he turned the cooker meter off. "When I turned the cooker meter that night it was not stiffer than at any other time; there was not the slightest difference; it was just as usual." "If Williams turned the meter off" the question was; and then he immediately said "But I am sure I turned it off;" and then he said "If it was off my action would have turned it on."

And this is consistent with the case presented on behalf of the plaintiffs, that however the explosion occurred it was on account of the action of Redmond, which, however, is insufficient to enable you to determine whether he was responsible, because he was thrown off his guard by something Williams had done. Then there was an answer that was much commented upon. "If I remembered what Williams had told me, I believe I would have done what I did." Then he gave some account of that apparently strange answer. The way he explained it was that work was going on, and the men who were dealing with the gas might for temporary purposes have turned it either on or off, so that it would—notwithstanding what Williams had done—have been a possible thing to have turned it on, and therefore it was a natural thing for him to turn it off on the occasion in question. He then said: "When I turned it off I was under the impression that Williams had turned it on again;" and he then said he knew there was a nick-line across the plug of the cock; that he had seen it. "But," he added, "I don't know what it was for. I did not notice any particular direction of it at any time. I always went as far as the lever and until it stopped." And then he went through the process which was gone through so often, and indicated to you the actual way in which he did it. He said then: "The key was not tight on," and whether he really was thinking of what he said before, that it was stiff on the nut or not, I don't know, but then he said "The plug was tight but not the key." Then he said that one was stiffer than the other two—that is, that the cock of this particular cooker-meter was stiffer than the cock of the other two meters. He said a moment afterwards, "The key was not tight on; it was loose." That seems somewhat at variance with what he said before; and he said a little further on, "It was always stiff to turn, but not a bit more so that night than on any other occasion." And then the remark was made semi-jocularly and semi-seriously—a kind of question that was put to the effect "Are you telling the truth?" and the curious answer was that he did not know. But I think what he really meant was that he was not sure whether the evidence he was giving was correct or not. You heard him and I only ask your consideration of his evidence.

On re-examination, he says there was only one conversation with Williams on the subject. There were other questions put with a view to suggest that it was possible with regard to the time that the conversation took place that sufficient time had elapsed to make it reasonable for him to forget.

I cannot pass on without referring to some portion of the evidence of the next witness. He was an independent witness and has been

referred to by both sides, and his evidence has been contrasted with the evidence of Rush and other witnesses. Martin Lambert, of the Fire Brigade, went there on the Saturday morning, Nov. 2, and appears to have been almost one of the earliest persons among the witnesses who were examined who arrived there after the explosion and after the girl who described the explosion. She was up at half-past six, and spoke of the explosion and fixed the time; and Mrs. Stewart spoke of it also at the same time. He says that having got the call, he was there at five minutes past seven in the morning. It occupied from the time he got the call at the Fire Station something about a couple of minutes. He then describes the way in which he came up in front of the premises, and the condition in which he found it—a good deal of wreckage and broken glass. He thereupon went below with two men and he said that Rush, who was in the Gas Company's employ, was one of them. He said he did not to his knowledge see anybody connected with Messrs. Forrests. The object of his going down was to examine the meters. He did not take a light down until he felt by experience there was no danger of any further escape of gas or explosion; but having, as I gather, felt his way or groped his way to the meters, he ultimately got there. When he found there was sufficient light to enable him to get there, and there was no danger of anything like an explosion, a match was lighted by Rush, and then he said he examined the meter. The first meter he met with was turned off—that was the stove meter, supplying the stoves other than the cooking stoves. The next meter was the far one—that was the domestic supply meter which was utilized for supplying gas for lighting the house. It also was off. "I examined the centre one, then—the cooking meter—and found it turned on. All were connected with the street main. There was no disconnection of the pipe at the meter. Rush called my attention to the meter being on. He turned it off with the handle that was on it. I could not say what position the handle was in before he turned it off; but I saw him turn it. I did not notice whether there was any difficulty in turning it. I saw him turn it. He turned it in the ordinary way to the best of my knowledge. He simply said that it was off. I left the meter-room after that." He left the premises about half-past nine. A little later he returned, and found that some other things had been done—namely, that the three meters had been quite disconnected from the main pipe, and absolute security effected.

His cross-examination largely repeated what he had said before—that he could not say in what position the key was; and in re-examination he remarked: "There was nothing exceptional in the way I turned it off; if there had been any difficulty about it, I would have observed it. I was standing close by, the three of us came up together." And then to wind up, "I cannot say whether he exercised much force or little. If he says he used much force, I would not contradict him. Rush made no remark." That has been commented upon inasmuch as it was said by Rush that he did make a remark which might reach the ears of Mr. Lambert, whose truthfulness is beyond question. The remark was "stiff;" and Mr. Lambert says he did not hear that.

I need not trouble you with the evidence of Robert Sharp, the Secretary of the Company, who explained the charge he had of the different doors, and the extent to which he was able to control them with the master-key, which was with a view to satisfy you that such precautions were taken that other persons could not have got in and interfered with the meters in question. Thus the only persons whose acts we have to consider are the persons who were before you as witnesses in the case. Another witness, the housemaid, had the key. She says she saw Williams between half-past three and four in his workshop, and she saw Mr. Sugg behind him in the workshop.

Another witness is Mr. M'Garvey, a member of the Institution of Mechanical Engineers. He did not come on the scene until Nov. 5. He then visited the Messrs. Forrests' premises and examined the different places—the gas-cooking room, the meter-room, and the fittings in the basement; and he said that then when he went to the gas-cookers he found that there were two, one a double one and one a single one. He said that at that time they were drawn out somewhat from the wall, and the single one did not seem to be drawn out quite so far as the other. He spoke of the different gas escapes, but the disconnection work resulted in there being three places of considerable size at which, if the meter was turned on, the gas from the pipe would escape. The apertures appeared to be in the disconnection of one of the pipes of the small meter and in two of the pipes which supplied the grills. Now the whole of this detail shows that what had been done resulted in there being left there three apertures practically in the supply pipe through which, if the gas was turned on, it would be allowed to escape. He said the disconnections were such that if the gas was on at the meter it would escape at these three points. He says the gas-cooker meter had its supply from the main, and was capped and stopped off on the 5th of November—one of the matters they suggest ought to have been done at the time Williams was at work upon it. He says the plug on the stop-cock was screwed harder, a thing which it was suggested Williams had not done, at all events to the extent to which it has been contended it ought to have been done; and then he says he tested the stop-cock with the key and was not able to move it. It was tightened up, and it has been suggested that this could have been done so that no amount of force could open it. But if you did so, you would be doing something which would be beyond what was reasonable.

Now some questions were put as to what suitable precautions would be, or what dangerous neglect would be. It will occur to you as common sense that what a man is bound to take is all due and reasonable precautions having regard to the circumstances of the case. You may be able to suggest that he should have done something or done something else, and it would have been more perfect. Absolute perfection is one thing; due and reasonable precaution is another. And it does not necessarily follow that because you can point out something that would have been more effective than what has been done, that therefore what has been done was not a reasonable and sufficient precaution in itself. But evidence has been given by persons who are supposed to be competent to give their opinion; and this is the evidence of Mr. M'Garvey: "Would it be a reasonable precaution to screw up tightly the stop-cock in a case where three apertures existed in the supply pipe, that were controlled only by the stop-cock?" He said: "It would be a precaution, but it would not in my opinion be absolute security." The way in which the question was put does not include a reference to one of the important circumstances in the case—that the man who had charge of it had been warned to the extent of being told that it had been turned off. He then said: "In my opinion to cap-off the main would be absolutely safe." And then he says with reference to another question that was put to him, in case the man had no cap with him, what would be a reasonable precaution to take in the case where there was a lead pipe between the cock and the meter as in this case; and he says the lead pipe might be cut and hammered-up. He added that there would be no difficulty in a skilled man plugging the three apertures of the cookers at the supply pipe. Then he was asked "In your opinion, as the result of your experience, was the leaving of three open apertures controlled only by an unscrewed stop-cock a dangerous state of things;" and he said it was. But a controversy here was that it was unscrewed. He then interposed by saying he had a very large experience (extending over 45 years), including work done by the Alliance Gas Company. He then said: "On the 5th of November, I did not use force; but I found the plug screwed up. I used reasonable force; sufficient to move any well-regulated cock." And he said: "It would not move; and I am able to swear it was at that time screwed up tightly."

Now in the conclusion he said that a man who found the key upon the stopper hanging down in the way the key was said to be put upon it—that he could not move it by pulling it towards him—if it were in the condition in which it was suggested it was upon the other side. Anyway, the thing was done. It is not suggested that anybody but Redmond did it; and in some shape or form he performed some operation which (it is part of the plaintiffs' own case) had the effect of turning it on. He then said, "If the key had been, as we suggest, left hanging down, it would have been impossible for Redmond, by the movement that he made, to have turned it off." That was Mr. Henry's suggestion from the operation he performed.

As to Mr. Jones's evidence, I will not have to trouble you at any length. He was in the employ of the firm of Messrs. Curtis and Son, and is asked this question with reference to what is here being investigated: "If when the gas-cookers were being disconnected from the supply pipe in the way that the disconnections were described to-day, what precautions would be necessary to be taken to prevent an escape of gas at the points of disconnection?" He gave an involved answer: "Seeing that the three open connections would not be stopped-off for want of the brass cock which was retained on the smaller pipes, I consider that the fitter should have capped-off that pipe." Then he went on to say that at the meter simpler precautions could be taken by the fitter—namely, to disconnect the lead pipe connecting the stop-cock and the meter; tighten up the plug of the cock; and place an iron cap on the outlet of the pipe. And he went on to say that a variety of other things could have been done. He said he could have disconnected the lead pipe and hammered it up. He said he could have disconnected the lead pipe and gone to the meter itself, and there he could have put a cork or plug (that would be most effective) into the meter, and so checked off the possibility of gas getting through. And all these things would have been precautions which would have stopped gas from going through. But he added the plug should in all cases be tightened up and the lever lifted; and he said that this applied to every one of these precautions.

With regard to the lever, as far as Williams is concerned, it might have been going a little out of his province if he interfered with the custody of the lever. The last question was, "In your opinion as the result of your experience, would the leaving of three open apertures in the supply pipe controlled only by an unscrewed-up stop-cock be a dangerous state of things?" He said it would. The same question was then put to him, screwed up stop-cock for unscrewed-up stop-cock, and he said he still considered it would be a dangerous state of things. Then he said "a man should not, in my opinion, leave the premises with openings of that kind there during his absence."

I need not refer you to Mr. Sampson's evidence, because he was the gentleman to whom the keys were handed; and I need not trouble you much with Mr. Ashworth's evidence. In the course of his cross-examination by Mr. Ronan, the account cropped up for work done in fitting up these cookers. That was by the Richmond Gas-Stove Company; and it was paid for to the Richmond Company.

I will now recall your attention to the evidence of a very important witness, Joseph Williams, as contrasted with the evidence of Redmond. There is no doubt about his position. He was simply a fitter at the work there. He says he has been a fitter for the last twenty years, most of the time at work in Dublin; but at the time in question in the actual employ of the Gas Company and doing work for them at Messrs. Forrests. He said he went into the employ of the Gas Company in the May previous, and went to work at Forrests in July. He said that Mr. Sugg was his foreman, and was the person who would point out the work he was to do, and did so, and that he was there almost every day. He said: "The whole of the three meters were there when I went," and each (other than the cooker meter) supplied the stoves and the light, and he said that the cooker meter supplied the cooking stove. Here is what he says occurred on the 1st of November. He spoke as to the three labels having been there—three perfectly legible and distinct labels. "On the 1st of November, Friday, I was at work in Forrests doing work which Sugg had pointed out to me to do on the previous day. On that day, Friday, between half-past two and three o'clock, Mr. Thackaberry came down the basement passage calling out did anyone see the gas-fitter. I came out of the workshop where I was at the time, and met Mr. Thackaberry there. He brought me over to the door of the old kitchen and said "Do you see these cookers? I want you to shut the gas off these and disconnect them." I hesitated for a moment. He then said "Williams, these are my instructions, and I want it done at once." I said then "I will do them now, Sir." Mr. Sugg was not there at the time. He said "I went down there to the gas-meter, to the cooker meter, and shut off the gas. It was the only supply to the cookers. I turned the cock off at the meter. I pulled the key towards me, which would have left it in a horizontal position. I found it straight down before I pulled it. I left the handle looking out to me. The handle was left on the square; the plug of the cock was on the loose side. It could be turned on and off freely, but was tight enough to remain in this position even

with the key hanging on it. I next tightened the nut on the tail of the plug. The nut screws on the plug and tightens it. I tightened it on with the footprint (the trade mark of the wrench), which was a suitable instrument for the purpose; and I made it very stiff. I left the plug tight; so tight that it would require a considerable effort to move it. I did nothing else then. The handle was then up to the iron pipe which rose up in horizontal form. I had not taken off the handle nor put it hanging downwards, nor turned the handle from me. When I left the place the gas was clearly turned off and the plug tight. I came to the cookers and disconnected them. The whole job took about half-an-hour. Mr. Thackaberry was at the door when I went in, and when I was disconnecting the cookers. He remained partly in the kitchen while I was at the disconnection, and he said nothing to me, nor I anything to him; but he saw me beginning to disconnect them. Mrs. Stewart, the housekeeper, came in when Mr. Thackaberry was going out, and saw me at the work of disconnecting. When I had finished disconnecting I went off to my other work. Mrs. Stewart said that she had selected a cooker in the Exhibition. This indicated that the operations that Williams performed would be of a permanent character. Up to that time Mr. Sugg had not been there; and so far as I know he had not known of the cookers being disconnected. He came to the ladies' dressing room where I was about 4 or 4.30, when I had disconnected the cookers. I saw Mr. Thackaberry twice that day. Except on that occasion I never had orders from Mr. Thackaberry about work."

Then witness spoke about Doherty, a boy who was with him as a helper. When he saw Mr. Sugg at 4.30 he and Doherty went down to the basement, and Redmond was there. He continued: "I knew that he was the man that turned the gas off. He was standing in the workshop. Doherty was there also. I said to Redmond 'that cooker meter is shut off, and the cookers in the kitchen are disconnected.' Redmond said it was a good job. I said of all the jobs I ever was in this 'takes the biscuit,'" and then he went on to say about being cut into fifty different pieces by Mr. Thackaberry. This was not intended, it was explained, that Mr. Thackaberry was giving him orders to do work, but was hurrying him in order to get the rooms that he was in charge of. He was cross-examined at considerable length, and went over again a great deal that he had said before. He was asked in reference to the terms of his employment, and said he was paid weekly wages. It appears that he was paid by the Gas Company his wages for the week which would have included the Friday on which this operation took place; and whether you think that that would at all amount to a recognition of him as their servant will be a matter for you. The time he was at the operation was half-an-hour. If he had not reported the matter he was doing, it would seem to me (that is a matter for you) that it would not help us very much in the case—much less involve the Gas Company in responsibility for him during that period as their servant. He then said, "I took no orders from anybody except Mr. Sugg, except that one order from Mr. Thackaberry with reference to the disconnection of the cookers." He said that he had often told him to get such and such a room ready and get out of it with all the expedition he could; and it was with reference to that that he used the expression about the fifty pieces. "Except on the one occasion he never gave me an order in his life." He then repeated that on the Friday between half past two and three he gave him an order about the cookers. It was in the workshop. "It was not between 11 and 12 o'clock he gave it to me, as Mr. Thackaberry seems to think. The first time I saw Mr. Sugg after that was 4.30 o'clock. He came to the ladies' dressing room and remained there about five minutes, and then he left. I did not see him afterwards. I did not see him at all in the gas-cooking room that afternoon. It was only in the ladies' dressing room I saw him that day. He says it was downstairs; but I was not with Mr. Sugg downstairs or in the basement at all that day. He came into the ladies' dressing room, and I said to him I had disconnected the cookers in the kitchen. What cooker? said he. I said the cookers in the kitchen. I told him Mr. Thackaberry wanted to see him. It was just about when I was leaving off—about 20 minutes to 5 o'clock—that I saw Redmond. Redmond got the information that he did get about 5 o'clock that afternoon. He said I finished the disconnection of the cookers about 3 o'clock, and then he went into the workshop and Mr. Thackaberry and Mr. Sugg were there. I did not tell Redmond that Mr. Thackaberry and Mr. Sugg were in the cookery kitchen. He said that I told Redmond I had shut off the cock at the meter, and disconnected the cookers in the kitchen. I said nothing else to him. I told him first about the cookers. I went there to see Redmond, and found him there. I did not say anything to Mr. Thackaberry as to what I had done about the cookers. Redmond was the only person I mentioned it to." He then said "I never had disconnected a cooker in my life, and I knew absolutely nothing about cookers. I thought I had disconnected the whole three of them; and I thought that I had the whole of the pipes disconnected." It appears with reference to the evidence of Mr. M'Garvey that there had been some disconnection not completed with regard to one of the cookers; and he explained that by saying that when he set to work he had to use a piece of iron pipe, that he moved it a little further away in order to get at the connections in such a way that it concealed from him a pipe he had omitted to disconnect; and the materiality of that is that he did not make as expert a job as he might. He says that he was in a hurry to get the thing done, as he had another job in hand; and he says he took all the care a man could take, although he missed one of the connections. He said "Before I began disconnection, I had not seen Mrs. Stewart. I had a conversation with her while I was disconnecting. Before that I had arranged the cocks of the meter; and I had done so to prevent the gas passing." Then he said a little further on that, though Doherty was with him, there to help him if necessary, he did not require his help; but he stood by him while screwing-up the cock, and that he thought it was better to get Doherty to help him. He described how he did it. He says: "The object of the nut there is for the purpose of adjusting the plug; and I tightened it to show Redmond that it was stiff—stiffer than it had ever been. I tightened it as much as I could the way that he would know about it. I told him all about it. I tightened the cock as well as I could. I had no cap with me. I was taken unawares. I don't think it could be tightened so tight that the handle could not turn. I first turned it off, and then tightened it up. It would have required a tremendous amount of force to have turned it at the handle after I tightened it up. I did not plug the open apertures. I did all I could; and I thought I had done enough." Then he repeats that he told Redmond about it, and that part of what he told Redmond was not that he had screwed it up tight. He repeats that he told Redmond that he had cut off the gas and disconnected the cookers. He said it was possible to take the handle off; but "if I had taken away the handle the cock could not have been turned at all." Asked whether he is sure he did not turn the plug after tightening it up, he said he did not.

I need not delay you with the testimony of the helper, Charles Doherty, which corroborated his evidence. But there was a suggestion by Mr. Chambers that the similarity of the evidence in the case of Williams and the man who worked under him would go to show that they had made up their story together. Whether you think that or not is a matter for yourselves. You can judge the extent that you think the evidence was real, and whether there was any foundation for the imputation suggested that these two witnesses had gone over the story in relation to matters that did not occur at all, so that their versions might tally one with the other. Doherty does not corroborate Williams with reference to all matters that occurred in his presence, and that he told Redmond the meter was off and the cookers disconnected.

I pass on to John Rush's evidence as quickly as I can. He it is suggested is a person we should look on with some caution, because he is an employee of the Gas Company. Well, he is; and if he had any sympathies, they would probably be with the Gas Company more than with Messrs. Forrests. But that is not sufficient, unless there is something else, to justify us in disbelieving him. His evidence, in some respects not immaterial, corroborates Williams'. He tells us that he has been in the employ of the Gas Company for a considerable length of time—some 29 years; and he is in the position of a man of some consequence there—a foreman main-layer. He heard of the explosion about 7.15 on the 2nd of November—the Saturday morning after it occurred; and he says at the time he was in the Hawkins Street premises where the Gas Company appear at all events to have stores. Having heard of the explosion he went off as quickly as he could to Messrs. Forrests; and by that time the Fire Brigade had arrived. It is commented upon that two persons who might be supposed to give relative testimony have not been called as witnesses. It is legitimate for Counsel, if he thinks fit to do so, to comment on such a matter; and it is clearly legitimate for a Jury to consider what an uncalled witness might say. It is legitimate for a Jury to consider that the party who was not called would not have advanced their case. The three men who were not called were with him. He says Lambert and the other three (the four of them) went down to the meters. They examined the meters the day after the explosion. He examined the meters, and found there was no smell of gas, and he struck matches for a light. The men who were not called were Jones and Lambert. This was an early examination of the place, apparently before 7 o'clock when his men examined each of the three meters. But at a later stage, about half-past nine, the cocks were undoubtedly put into a different position. He says, "I myself examined each of the three meters. Two of the meters—that is, the one for the stoves and the one for the lights—were turned off, and the centre meter was turned on. I could not tell how the handle was. I looked at the meter, and the handle was on the cock; but I could not tell what way it pointed. I looked at the nick of the cock, and not at the handle. I pointed out to Lambert and the other man that the cock of the centre meter was on. I pointed out in the case of the other two cocks that they were off. I turned off the cock of the centre meter. The handle was on the cock; but I could not see which way it pointed. I turned it off at the handle. I did not take the handle off either before or after I turned the gas off. The plug was stiff. I had to use a good deal of force to turn it off. I noticed that at the time; and I passed the remark that it was stiff." Lambert says he did not hear that; but if one man did not hear it, and another equally credible witness swears that he said it, the balance of the testimony would rather appear to be in favour of the man who says a thing was said, as against the man who swears that he did not hear it. "We read the label on the meter that was turned on; it was to the effect 'control of the gas cookers.' I left it on. I left the handle in the position in which I found it." In connection with the stiffness, he said "I thought it was a cock that had never been used; it did not occur to me that it had been screwed up." But whether he thought on the matter, what he has undertaken to depose to is that it was stiff—sufficient to require considerable force to turn it.

Mr. Gillespie is another of the not unimportant witnesses. He is in the responsible position of the Company's inspector for the district; and he says that on the morning of the explosion he was at Messrs. Forrests. He did not arrive there until a later period—somewhere about 10 minutes or a quarter past nine. He went into the meter room and asked permission of Mr. Thackaberry for the purpose. He says it was then daylight, and he examined the meters. All the cocks were then off. Here is what he says about the centre meter, which is the cooking meter: "I examined the cock of the centre meter, and found it quite stiff." Now it is not impossible that that might have been done afterwards. There is no direct evidence about it one way or another; somebody might have done that. But as a matter of fact there is no evidence it had been actually touched. "I found it quite stiff. I found it tightened. I examined it for that purpose. I mean by tightened, tightened by screwing up." And then he took the very secure precaution of capping-out those places where the gas would have come. He was cross-examined, and his cross-examination led him to repeat a good deal of what he had said before. He said, "You cannot tighten the plug so that you cannot in any way turn it with a lever."

Next came Mr. Goodenough, who had been relied upon on the other side. They asked him what, in his opinion, would be sufficient or insufficient. He presents himself as having about 1000 fitters under him. I will go over the questions that were put to him. He is asked, "Assuming that the gas for these cookers was supplied by one meter which supplied nothing else, and that the manager of the establishment in which the meter was had himself given directions for disconnecting the gas-cookers, and that the man who had charge of the meters for the establishment knew they were disconnected, from your experience would it be a sufficient precaution to turn off the gas at the

meter and screw up the nut?" And Mr. Goodenough gave the answer: "Yes; but there is another assumption, and that is that the man having charge of the meter" (this would be Redmond) "had been told that the meter was turned off." Mr. Chambers referred very fully to some of the matters on which he contended Mr. Goodenough and another gentleman who was examined were witnesses for him. They regarded the operation as adequate on the assumption that the disconnection was for a temporary purpose, and that the fittings were about to be used again in some reasonably short time. Mr. Chambers has drawn your attention to it. His view was that if the man who took charge of the meter had been recently told of the disconnection, there would be little risk of his having forgotten it; but if a considerable time had elapsed there might. He then said at the end of his examination: "By permanent disconnection I mean that the pipes would not be used for any other purpose." Mr. Edgar, a contractor from London, with 250 men under him, is asked the same question that was put to Mr. Goodenough, and he is of the same opinion—that this would be an adequate precaution. "If my men had done such work under similar circumstances the precaution would have been sufficient. If the disconnection was permanent, capping would be adopted. I would consider the screwing-up quite as efficient as cutting the lead pipe and hammering; and if my man was aware that it was temporary, it would be waste of time and material to cut the lead pipe, and ought not to be done." And then Mr. Chambers at once asked him what would be the extent of the damage. He thought a pipe could be restored for something like half-a-sovereign; and he said the screwing-up alone would not be enough, but that it would be sufficient to warn the man that a change in the meters had occurred, and that a meter was turned off. Mr. Chambers claimed that this witness was a witness for him.

The next was Mr. Howell, who told you that the stove which was ordered was ultimately not put up; and this was presented as showing that there was an intention not to leave the fittings permanently disconnected, but that at some (not very definite) time to utilize them for another purpose. It was commented on that this was not brought to the mind of Williams at the time.

The last witness in the case gave the explanation with reference to the account in which the sum of £34 was shown to be paid for the fitting-up of the cookers, and it appeared that it was done by the Richmond Stove Company, as work that they were entitled to be paid for and not work done on behalf of the Gas Company at all.

Now I am sure you will pardon me for, after a six days' trial, having done the best I can to refer you to the material parts of the evidence that I thought it important for you to consider; and I can only add that anything I have not drawn your special attention to you are not to imagine that I have overlooked. But a vast amount of evidence must be given which when the case closes has practically worked itself out and does not bear on the important questions. Therefore the two questions I will leave you, and on which I will get your answers as a matter of fact, are: First, Was Joseph Williams while he was disconnecting the cooking-stoves and gas-pipes and shutting off at the meter the supply of gas to these stoves, doing work with the defendants' authority as their servant? It is not enough that he should be at the time in the employ of the Gas Company; you have to investigate further whether in the particular operation he was performing he was doing it with their authority or on the order of Mr. Thackaberry. Next, independently of what conclusion you would come to on that, it is best to have answers to these questions so that there should not be any longer investigation of this case: "In your opinion, from a deliberate consideration of the whole of the evidence, was there negligence on Williams's part in the performance of the work he did?" It would not be useful or desirable for me to say to you more than I have said already. It is not for a man to have performed every possible act that it could be suggested he ought to have performed. The real and substantial question is, Did he do all that was reasonable or in the judgment of the Jury necessary, or did he omit some precaution that a reasonable man ought to take. And the extent of the reasonable care ought to be estimated with regard to the work in hand, if the result is likely to be serious. And then a further and important question. If you come to the conclusion (it is entirely for you) that there was negligence on Williams's part, was it that that caused the accident? If there was negligence on his part and nothing else, and that you think the explosion was the actual result of that negligence, the question ought to be answered "Yes." But if you think there was something else in the case, and that there was some other negligence in the case for which other persons were responsible—in this case in Messrs. Forrests' employ (namely Redmond), and I think his is the only action that would be regarded as bearing on that, and that that practically contributed to the accident occurring, and was one of the efficient and effective causes of the explosion occurring, and in that sense both were taking part in what was causing the accident—then you ought not to answer the question was it occasioned by the negligence of Williams although there may have been negligence on Williams's part, because what really would have occasioned it in that event would have been the negligence of the two. You are not to investigate anything in connection with the damages that will be awarded, whether they are great or small; you are not trying that. When you have answered these questions, the parties will be in a position to deal with the rest of the case.

The Jury, after more than an hour's deliberation, handed down their findings.

Mr. JUSTICE ANDREWS: With regard to the first question, Was Joseph Williams while he was disconnecting the cooking stoves and gas-pipes and shutting off at the meter the supply of gas to the stoves doing the work with defendants' authority as their servant? Answer: No. Second, Was there negligence on his part in the performance of the work? No. If so was the explosion of gas caused by such negligence on his part? No. Then, gentlemen, that is a finding for the defendants.

His Lordship gave judgment accordingly.

The Farnham Gas Company have given notice that they intend to apply for a Provisional Order conferring upon them powers to supply electricity for public and private lighting. During the past eight or nine years, four similar attempts have been made.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION

And their Concessions.

In last week's issue (p. 986), we reproduced two statements from the "Financial Times" with regard to the gas supply of Vienna and Frankfort-on-Main, in which places the Imperial Continental Gas Association possess works. Our contemporary further referred to the matter on the 29th ult. in the following terms.

A somewhat alarming telegram has just come to hand from Vienna concerning the affairs of the Imperial Continental Gas Association in that city. It is asserted that the Municipality have refused to extend the concession of the Association, which expires in 1911, for another term of 25 years; that they have also refused to purchase the Association's gas-works at the termination of the concession, preferring to build their own; and that, finally, they have refused even so much as to buy the English Company's mains. The first of these statements is correct; the second, in its bald form, is somewhat misleading; and the third is absolutely inaccurate.

The facts, according to inquiries we have made in authoritative quarters, are these. The idea of municipalizing the gas system, as well as other public service systems, having of late years found favour in Vienna, it has been practically certain for some time past that the Imperial Continental Gas Association would not have their concession renewed after 1911; and the City Council have, in fact, already taken steps to ensure the construction of their own gas-works in time to commence supply as soon as the English Company's concession lapses. This supply they will naturally give through the mains, service-pipes, street-lanterns, &c., already existing. Article 6 of the contract for the supply of the Vienna suburbs with gas, signed on April 29, 1899, by the Imperial Continental Gas Association on the one part and the Municipality of Vienna on the other, runs as follows .—

> It is hereby agreed that on the 31st of December, 1911, the Municipality shall purchase the mains, service-pipes, candelabra, brackets, lanterns, and gas-meters in the territory covered by the contract, so far as such mains and lighting plant are the property of the Association. The purchase of the above-mentioned objects shall be effected by the payment of a sum to be determined by means of a judicial valuation, which sum shall be due after the valuation is completed.

In the event, now seemingly determined, of a non-renewal of their concession in 1911, the Company's position is as follows: (1) Their amortization fund will have provided by that date for the complete redemption of the entire capital sunk in the undertaking. (2) They obtain in cash from the City Council the price of all the lighting plant owned outside their gas-works. (3) They have in hand for sale the large building site occupied by the gas-works, which is now situated in a popular neighbourhood, and the "unearned increment" value of which has been progressively increasing since its first acquisition by the Company as far back as 1842. (4) They retain their business hold in the Austrian Capital by various concessions from Floridsdorf and thirteen other small communes which are independent of the Viennese Municipality. They are situated on the left bank of the Danube; and the contracts with them run on till dates varying from 1919 to 1942, but mostly expiring about the year 1930. This was the state of affairs when, to tempt the City Council to postpone expropriation for another 25 years, the Association proposed to reduce the price of gas and hand over the gas-works and plant free at the end of that period. To have secured a renewal of the concession would, no doubt, have been good business; but the refusal of their offer by no means places the Company in a bad position.

The concession enjoyed by the Association for the gas supply of Frankfort-on-Main also comes up for revision at the present moment. Frankfort, however, unlike Vienna, has made no preparations to carry on the gas supply of the city on its own account; and though it would be physically possible, at great expense, for the Municipality to construct the necessary works and lay the required plant by April 1, 1911, when the concession expires, it is thought unlikely that it will do so. In Berlin, the Association have worked on friendly terms with the Municipality for something like half-a-century, sharing with them the gas service of the city and the very extensive surrounding suburbs.

OLDHAM CORPORATION GAS UNDERTAKING.

General Manager's Report on the Past Year's Working.

The General Manager of the gas undertaking of the Oldham Corporation (Mr. Arthur Andrew) has presented to the Gas Committee his report on the working for the twelve months ending the 25th of March. It furnishes the following particulars.

The expenditure on capital account during the year was as follows: Oldham station (land), £60; Higginshaw station, £5973; Hollinwood station, £5043; Gas-mains, £1011; Gas-meters and cooking-stoves (less depreciation), £2088—total, £14,175. The gross revenue was £171,619, and the gross expenditure £145,114; the balance carried to profit and loss account being £26,505. The annuities during the year amounted to £3342; the interest on loans and stock, to £13,271; and the sums payable to the respective sinking funds, to £5420—making altogether £22,033. The net profit on the year's working was consequently £4472. Adding the balance brought forward, £20,565, and one year's accrued interest from the annuity redemption fund, £548, there is a total of £25,585. Deducting the amount to which the Corporation are entitled in aid of the borough fund, £8652, the credit balance to be carried forward is £16,933.

There was a decrease last year in the amount received for all residual products; the average price obtained for coke being 11·33d. per ton less than during the year 1907-8, and 4s. 9d. per ton less in the

case of tar. Coke values were nevertheless well maintained, taking the fall in the price of coal into account. The reduction in the cost of coals, &c., used during the year of 0·254d. per 1000 cubic feet was more than counterbalanced by the fall in residual values, which was equal to 1·065d. per 1000 cubic feet. Carbonizing wages were further reduced by 0·227d. per 1000 cubic feet of gas manufactured.

There was an increase in respect of the repairs and maintenance of works amounting to £2653, due partly to the enlargement of purifiers at Hollinwood (the estimated cost value of the old set being debited to revenue), and partly to the number of retorts renewed and repaired at Higginshaw and Hollinwood having been above the average. There was an increase of £863 in the expenditure for distribution, due to an increased number of cookers having been fixed free, and to the large number of old meters which were exchanged for new ones without charge. The cost of fixing cookers free during the year amounted to £1839.

The quantity of gas supplied to the street-lamps and municipal buildings free of cost was 82,735,000 cubic feet. There were 110 additional gas-lamps erected within the borough, and 57 in the out-townships. The total number of lamps fixed in the district of supply on the 25th of March was 5745. The total number of lamps of the incandescent type at that date was 3382 within the borough and 1008 in the out-townships; being an increase of 1665 during the year. The number of lamps then fitted with flat-flame burners within the borough was 541; but all these will be changed to the incandescent type during the current year.

The quantity of gas manufactured at the different stations during the year was: Oldham, 108,050,000 cubic feet; Higginshaw, 696,182,000 cubic feet; Hollinwood, 552,469,000 cubic feet; do. (water-gas plant), 77,942,000 cubic feet—total, 1,434,643,000 cubic feet, compared with 1,471,434,000 cubic feet in the preceding year, being a decrease of 36,791,000 cubic feet, or 2·5 per cent. The following quantities of coal, oil, and benzol were used in its production: Coal, 115,789 tons 7 cwt.; gas oil, 256,996 gallons; benzol, 117,087 gallons. The average quantity of coal gas made per ton of coal carbonized was 11,717 cubic feet, compared with 11,539 cubic feet in the year 1907-8. The loss of gas from leakage, &c., was 70,017,000 cubic feet, or 4·83 per cent. of the quantity made, compared with 75,354,000 cubic feet, or 5·12 per cent., before. Many old mains were renewed during the year; and probably this has been a material factor in reducing the quantity of gas unaccounted for. The maximum quantity of gas delivered in 24 hours was 8,366,000 cubic feet, on Dec. 2, 1908, compared with 8,140,000 cubic feet the previous year; being an increase of 226,000 cubic feet. The minimum quantity delivered was 1,504,000 cubic feet on June 14, compared with 1,611,000 cubic feet before; being a decrease of 107,000 cubic feet. The average illuminating power of the gas, as tested by the No. 2 "Metropolitan" burner, was 20·13 candles.

The total number of meters fixed on the 25th of March last was 51,959, of which 1445 were of the prepayment type; 817 meters were fixed in new premises and others in which gas was not previously used; and 114 meters were permanently disconnected. The actual number of consumers on the above-named date was 46,435. The number of meters then fixed but not in use was 3097.

There was an over-expenditure on street lighting account of £2279, caused principally by 1363 lamps having been converted from flat-flame to incandescent lighting, and by the number of automatic lighting controllers having been increased from 112 to 593. The total amount expended on this account during the year, including the balance brought forward, was £5859. The amount received from the Borough rate was £3500, and the sundry receipts were £80; making a total income of £3580.

The net increase in the number of additional cooking stoves and grillers fixed during the year free of charge to consumers was 2512. The total number in use on the 25th of March was 15,016. There were 35 gas-fires, &c., sold during the year.

There was an increase of 10,007,000 cubic feet in the quantity of gas consumed by private consumers in houses and shops, and a decrease of 40,610,000 cubic feet in that consumed in mills and workshops; this being due to a dispute in the cotton-spinning industry and bad trade in the machine-works.

A comparative analysis of the expenditure per 1000 cubic feet of gas sold during the past three years is appended to the report; and this is followed by the accounts of the department, prepared by the Borough Treasurer (Mr. J. F. Lees), and certified by Mr. D. Cooper, of Oldham.

LONGTON GAS AND ELECTRICITY SUPPLY.

The Past Year's Working.

At the Meeting of the Longton Town Council last Thursday, the Gas and Electricity Committee mentioned, in the course of their minutes, that the annual statement of accounts had been presented and discussed, and it was recommended that the best thanks of the Committee be tendered to the Engineer and General Manager (Mr. W. Langford) "for the able and successful manner in which he has conducted the works, and on the satisfactory financial results obtained in each department."

In moving the adoption of the minutes, Mr. Hulse (in the absence, through illness, of Alderman Brookfield, the Chairman of the Committee) said the gas-works in all departments were in a most efficient state of repair, and all the work done during the past financial year in connection with renewals, mains, and meters, had been paid for out of revenue. Once or twice he had heard that the Longton works could not manufacture gas with results equal to those obtained in one or two of the Pottery towns; and the case was instanced of Stoke. He did not wish to say anything against Stoke; but there was a point which needed explaining. It cost Longton £3200 a year for interest and loan charges more than it did Stoke; and if Longton could retain this £3200, they would be on an equal footing with their neighbours, and at the same time be able either to reduce the rates by at least 6d. in the pound or supply gas at a very much lower price. If the facts he had referred to were considered, they would see that Longton was well able to compete with any of the Potteries towns. During the past financial year, the price of gas had been reduced by 5d. per 1000 cubic feet, and this had entailed a considerable reduction in revenue. Compared with the previous year, the receipts were £2644 less, accounted for, as explained, by the reduction in price and the loss on the sale of residuals. There was also a falling off of 3½ million cubic feet in the consumption, which was explained by the slackness of trade and the substitution of electricity for gas for street lighting. The prepayment meter system had become a paying concern; the consumption of gas having increased during the year by 2¼ million cubic feet. The current year, after meeting all obligations, was commenced with a balance of £388. The year just closed had been the most successful the Corporation had had, even allowing for the smaller revenue. The Longton Gas-Works, he might remind the Council, made more gas per ton of coal than any other gas-works in England; their return being 12,507 cubic feet. This was something to congratulate themselves upon, and another matter for gratification was the fact that the leakage and gas unaccounted for had during the last few years been reduced from 8·5 to 4 per cent., which, considering the district was one where the pipes were affected by mining operations, was most creditable. The Electricity Department had also had a successful year; meeting all renewals without adding to the capital account, and securing an increasing demand for current. The increase in production was 35 6 per cent. The Committee, who were trying to make the dual concern a highly successful undertaking, were thinking of extending the electricity generating plant by November next, at a cost of £2500, which would be paid for out of the reserve fund. In conclusion, he submitted that the Committee deserved the congratulations of the Council; and they themselves owed a debt of gratitude to the General Manager for the efficient way in which he conducted the works. When the time came to hand over the undertaking to the federated district, Longton would place in their hands a grand asset. It would be in a better state financially and in every other way than it had ever been since it had been a Corporation concern.

The minutes were passed.

BURSLEM CORPORATION GAS ACCOUNTS.

The total expenditure on revenue account of the Burslem Corporation Gas Department, for the year to Dec. 31 last, came to £21,285; while the receipts were £29,020. There was thus a balance carried to profit and loss account of £7735. The net profit for the year was £2321. The report of the Gas Engineer (Mr. Edward Jones) on the year's working states that 17,536 tons of coal were carbonized; the quantity of gas made being 211,057,000 cubic feet, or 12,036 feet per ton of coal. The unaccounted-for gas amounted to 9·3 per cent. There are 40½ miles of mains. Ordinary meters in use number 2412, and prepayment meters 4835; while there are 636 public lamps. The yield of sulphate per ton of coal was 28·03 lbs. The capital per million cubic feet of gas sold amounts to £679.

STOURBRIDGE GAS UNDERTAKING.

In his fourth annual report to the Stourbridge Urban District Council, on the working of the gas undertaking for the year to March 31 last, Mr. C. H. Webb, the Engineer and Manager, says that the sales of gas (ordinary, prepayment, and public lighting) show a small increase of 724,500 cubic feet, as compared with the previous year. This, he thinks, may be considered satisfactory, seeing that the general trade of the district has not been good. The revenue account shows an increased income from the sale of gas, and also from coke; the latter having more than balanced the reduced amounts received for the other residuals. The total increase is £210. The expenditure for the year is greater by about £16. These differences increase the balance carried to profit and loss account by about £195; the gross profit being £10,748. After deduction of annual instalments, and interest, &c., which are somewhat less, there remains as a surplus £2209 (an increase of £328), of which it has already been decided to transfer £1750 to the relief of rates. During the year there have been laid about 2 miles of mains; while there have been fixed 44 ordinary and 237 prepayment meters, and 172 cookers.

The accounts show that the gas made amounted to 212,851,000 cubic feet, of which 190,558,700 feet were sold, 2,806,500 feet used on the works, &c., and 19,485,800 feet, or 9·15 per cent., were unaccounted for. The expenditure on revenue account was £24,893; and the receipts were £35,641. The make of gas per ton of coal carbonized was 10,909 cubic feet; and the net proceeds of residuals came to 63·55 per cent. on the cost of the coal.

COVENTRY CORPORATION GAS UNDERTAKING.

Past Year's Working—Charge for Gas.

When the year's working of the Coventry Corporation gas undertaking was under consideration by the Town Council at their last meeting, a strong protest was entered by Alderman Andrews—a keen critic of business departments—against selling either gas or electricity below cost price. He said a comparison of the figures in the gas account showed that, taking the price all round, it worked out, including all charges, at 2s. 3d. per 1000 cubic feet. They found that nearly one-third of the production had been sold at less than this—in fact, at less than cost price. Something like 67 million cubic feet were sold at 1s. 9d., 51 millions at 1s. 10d., and so on. It seemed to him simply a question of sound business policy that at least they should get the cost price for the whole of the gas made. The smaller consumers, he asserted, had to bear a great deal of the loss made on the sale of gas to the larger users at so low a figure. Mr. Batchelor, the Chairman of the

Gas Committee, denied emphatically that they sold any gas below its actual cost. The price worked out at 1s. 9d. per 1000 cubic feet, while the lowest figure at which any was disposed of was 1s. 10d.; therefore it could not be said that they were selling at a loss. With regard to the cost of production, he pointed out that at the new works and under the improved conditions of manufacture, they would be able to considerably reduce the charges. Dealing with the result of the past year's working, he accounted for the great reduction in profits by three circumstances. In the first place, there had been a decreased consumption by the large manufacturers, owing to slackness in trade; in the second place, there had been an appreciable decline in receipts from the sale of residuals; and, thirdly, the undertaking had to bear increased capital charges arising from the extra expenditure that had been incurred. In the course of the discussion, the hope was expressed that efforts would be made to bring down the price to the small consumers in the coming year; a remark being made to the effect that it seemed as though prepayment meter users are being bled for the benefit of wealthy corporations and great firms. Of course, they are told that without the big consumers it would not be possible to run the department successfully. In reply to this assertion, however, it was argued that the small users were the best customers of the undertaking; and yet the amount of consideration they received at the hands of the Committee was, to say the least, very meagre and disappointing. The Council adopted the report and statement of accounts; and it was decided that £2000 of the £3248 net surplus should be devoted to the relief of the rates, and the balance carried forward to the next account.

THE VALUE OF THE CORRESPONDENCE COLUMN.

Gas v. Electricity at Plymouth.

The references in the speech of Sir Joseph Bellamy, at the annual meeting of the Plymouth and Stonehouse Gas Company, reported in the "JOURNAL" last week, to the unfair competition of the municipal electricity undertaking, has led to some newspaper correspondence. Mr. E. F. Anthony, the Chairman of the Plymouth Corporation Electricity Committee, alluding to the contention of the Chairman of the Gas Company that if it were not for the competition of the municipal electricity undertaking gas would be cheaper—or, as Mr. Anthony puts it, the Gas Company would make larger profits—says it is equally true that if there were no Gas Company the electricity undertaking would make even larger profits than it does now, and the ratepayers would derive greater benefits from the larger profits of their own undertaking than they would from those of the Gas Company. On the question of which is the more economical illuminant, Mr. Anthony contents himself with saying that the answer largely depends on the point of view. He dismisses the medical testimony quoted by Sir Joseph Bellamy as to the advantages of gas over electricity in their effect upon the eyesight by saying that an ounce of personal experience is worth more than a hundredweight of opinion; and he adds: "One has only to try reading or studying by gas and electric light to be convinced that the electric is not only more pleasant to use for the purpose, but much less trying to the eyes." Mr. Anthony hints that his "experience" would be borne out by shareholders in the Gas Company who use electric light in their own homes and offices. Coming finally to the question of the adoption of electric light for one of the schools in the town, Mr. Anthony says: "It is now an established scientific fact that an ordinary incandescent gas-burner consumes in a given time as much air as three ordinary persons. Electric light consumes no air, and has none of the destructive properties of gas. On grounds of health and ventilation, this is a very important point." Mr. Anthony thinks this was what influenced the Committee in the decision to have the school lighted by electricity.

Sir Joseph Bellamy, in replying to the argument of the Chairman of the Electricity Committee about the consumption of air by gas-burners, and the consequent diminution of the quantity of fresh air in a room, quotes an extract from the paper read before the Royal Sanitary Institute by Dr. Samuel Rideal, F.I.C., on "The Relative Hygienic Values of Gas and Electric Lighting."* Dr. Rideal's conclusions were: "The bacterial content of the air of a room is more likely to be reduced by gas than by electric lighting because of (1) the cremation of organisms in the gas-flames, (2) the sterilizing effects of the sulphur acids from the gas, (3) the removal of organisms by the greater condensation on cold surfaces, and (4) the increased ventilation of the room." With regard to the suggestion that shareholders in the Gas Company use the electric light in their own homes and offices, Sir Joseph says that the electric light in Plymouth, where gas is sold at 1s. 9d. per 1000 cubic feet, is a luxury; and gas shareholders, like other people, may indulge in luxuries if they pay for them. A municipal authority, however, ought not to have luxuries at other people's expense. As a ratepayer, and, on behalf of the Gas Company, one of the largest ratepayers in the town, Sir Joseph protests against the waste of money in installing electric light in the schools. He says that he and Mr. Anthony, among others, survived attendance at evening classes in rooms far less luxurious than those now provided and lighted by gas; and he concludes by suggesting that if the supply of electricity were in the hands of the Gas Company, both gas and electric light would be cheaper, while the profits would be circulated among local shareholders instead of being sent out of the town, as is the case with the municipal undertaking.

Cost of Gas and Electricity at Chichester.

In the "JOURNAL" last week (p. 988), we noticed the reply of Mr. T. E. Pye, the Engineer and Manager of the Chichester Gas Company, to some statements made by Mr. H. S. Aylmore, a member of the Corporation, on the occasion of the inauguration of the electricity supply undertaking in the city, on the low cost of electric lighting. Mr. Aylmore promptly replied to Mr. Pye in a letter to the local paper. He admitted that he made a mistake in stating that the light was on for 2½ hours, when it should have been 3¼ hours. Then he said there were some omissions from his speech, which brought up the number of lamps to 17, with 520-candle power; and he asked Mr. Pye to work out another sum by adding three-quarters of an hour to the 2½ hours, and 520-candle power to the 450-candle power mentioned, so that they might compare the result with the cost of gas. He added: "I have already made such comparison, and find that my gas bill for the quarter ending June, 1908, was £3 3s. 11d., or nearly 5s. a week for thirteen weeks; while the cost to me of electric light for fourteen days (June 3 to 17), including four bedrooms, which were never lighted by gas, was 8 units, or 2s. per week. On the other side, the gas bill includes that used in a gas-stove. But surely this does not cost more than 3s. a week; if so, there is not much economy there. . . . As one of the humble representatives in the City Council, may I not ask that the ratepayers should have some share in the advantage of this marvellously cheap gas lighting (hitherto unknown) in the public streets, for which they pay over £1100 per annum—by the Gas Company charging less than £3 10s. per lamp for gas which they can supply to a private consumer at 490-candle power for just under 1d. per hour, and suggest that the better illumination of the Cross clock would be a very good point to start from?"

To this letter Mr. Pye replied in the succeeding issue of the paper. Dealing with the cost of the public lighting, Mr. Pye said: "Mr. Aylmore asks that 'the ratepayers should have some share in the advantage of this marvellously cheap gas lighting (hitherto unknown) in the public streets . . . by the Gas Company charging less than £3 10s. per lamp for gas, &c.' Surely it is a first duty of the Chairman of a Committee to understand the accounts his department are called upon to pay. Chichester has not for years past, if ever, paid £3 10s. per lamp per annum for gas. This charge of £3 10s. is inclusive of all labour and other costs of lighting, extinguishing, and cleaning the lamps, and of glazing, painting, and general maintenance—not to speak of charges to meet depreciation, &c. If Mr. Aylmore will kindly make a calculation allowing for these things—the cost of most of which are published in my Company's half-yearly statements of accounts, and amount roughly to about 24s. per lamp per annum, he will find that the net charge for gas per lamp is about ¼d. per hour, which, for 490 to 500 candle power comes out at about 0·9d. per hour. If, further, Mr. Aylmore will give credit for the gratuitous lighting at the Cross clock and elsewhere, which he did not mention in his letter, but which, on the £3 10s. basis, is worth to the City about £56 to £60 per annum, he will find that the City has for some years past been paying for gas for its public lighting, at the rate of 490 to 500 candle power lighting, ¾d. per hour! I think, with Mr. Aylmore, that this is 'marvellously cheap gas lighting,' upon which the City and its representatives may well be congratulated."

Passing on to deal with Mr. Aylmore's corrections, Mr. Pye said: "Mr. Aylmore asks me to make another calculation on the altered basis. Exactly. Here it is: 450 candles *plus* 520 candles multiplied by 3¼ hours upon 1¾ units of electricity equals 3152½ candle-hours upon 1¾ units. This amounts to 1800-candle power per hour from 1 unit of electricity. This is a marvellous result, truly 'hitherto unknown'! The maximum lighting power of the lamps Mr. Aylmore is using is 760 to 800 candles per hour per unit of electricity consumed, and the average will probably be 700 candles. Will Mr. Aylmore kindly explain where he has picked up that extra 1000 candles? Frankly, Mr. Editor, I knew that the results as originally published in Mr. Aylmore's speech approximated fairly closely to the actual probabilities. Otherwise my earlier letter would not have appeared. Any of your readers can prove this for himself, on the safe basis of (say) 750-candle power per hour per unit, thus: 450 candles multiplied by 2½ hours upon 1¾ units of electricity equals 1125 candle-hours upon 1¾ units equals 643 candles per hour per unit. The difference between this 643 candles and the theoretical 750 to 800 candles may be due to the lighting having been, as Mr. Aylmore thinks, somewhat longer than 2½ hours. However, after the wonderful achievement now claimed by Mr. Aylmore, of 1800 candle-hours from one unit of electricity by Osram and carbon lamps, he need have no further anxiety as to such modest honours as have come my way as a result of my 'sticking to my own business,' and of certain research and constructive work connected with my profession. If he will only show to his friends the electricians how and whence he can obtain lighting at the rate of 1800-candle power from a consumption of one unit of electricity per hour, from the lamps he is now using, the professor's chair in electricity at one of our leading Universities will be the least of the honours that a grateful and, at present, a very anxious profession will desire to confer upon him."

Gas-Works Results at Tipton.—The Gas Committee reported to the last meeting of the Tipton Urban District Council that the gross profit on the gas undertaking for the year ending March 31 last was £5079, and the net profit £271. Out of this, £150 had been handed over to the Council towards the purchase of the mines under Bloomfield Road. Mr. Powell, in moving the adoption of the report, said the depression in trade during the year had resulted in a reduction in the consumption of gas, representing a decline in revenue of £1093 compared with the receipts of the previous year. A further loss of £395 had been sustained by a reduction of 3d. per 1000 cubic feet in the charge for gas for lighting purposes. The resolution was adopted.

Birmingham Coal Contracts.—The "Birmingham Mail" understands that the Gas Department have now placed their contracts for the whole of the 550,000 tons of coal required during the coming year. Mr. G. Hampton Barber, taking full advantage of the state of the market, has succeeded in effecting a saving of £15,000 odd, compared with the prices paid twelve months ago. Having regard to this, and the large profits made by the department last year, it is, says our contemporary, thought that the Gas Committee will consider the question of reducing the price of gas. Other corporations in the Midlands are arranging their contracts; and it is generally understood that the collieries are willing to give a reduction of 6d., but some corporations insist on 9d. Works using a large proportion of gas nuts and slacks will obtain an additional advantage; the reduction on these being greater than on coals.

* See "JOURNAL," Vol. CI., pp. 613, 686.

ELECTRICITY SUPPLY BUSINESS AT WEST HAM.

Referring to the inquiry by Mr. H. Ross Hooper in regard to the application by the West Ham Corporation to the Local Government Board for sanction to the borrowing of £74,600 in connection with the electricity supply undertaking, which was dealt with in "Electricity Supply Memoranda" last week, "The Times" says: "The inquiry has revealed a deplorable condition of affairs; and when it is remembered that West Ham has been engaged in an extended crusade against the measures brought forward by private electricity supply companies for the improvement of supply within the Metropolitan area, it is difficult to estimate the damage that this municipal body has done to the industry and to the ratepayer. The main point now at issue is whether the Corporation has supplied electricity to certain large consumers at so low a price that the present debt, in whole or in part, is the result. If it can be proved that the prices charged are inequitable, then it is clear that grave injustice has been done to ratepayers. Unfortunately, the issue is rendered more complex by evidence to the effect that the Corporation has carried out electrical work beyond the limits of its own borough, and that it has supplied foreign-made cable which might be mistaken for cable made by leading firms in this country except by the experts who were called in and who declared that it was not their own product. Such practices are said now to be discontinued. They may have been unintentional; and it is unnecessary, therefore, to dwell upon them except to indicate that municipal enterprise loses prestige by transactions of this kind. The official inquiry is helpful so far as it goes; but unless it is followed by a reform equivalent to reconstruction, the expenditure of public money will have been to no purpose; for West Ham will probably issue a supplementary rate, and there will be nothing to check the further growth of debt upon the undertaking. The only hope seems to lie in a transfer of the whole electricity supply concern to a private company."

METROPOLITAN WATER BOARD.

Resignation of Lord Welby—The Value of Storage before Filtration.

At the Meeting of the Metropolitan Water Board last Friday, a letter was received from Lord Welby resigning his seat on the Board. The Finance Committee, of which Lord Welby has been Chairman since the inception of the Board, reported that they had placed on record their deep sense of the valuable services he had rendered, and of the great loss the Board had sustained by his resignation. On the motion of the Vice-Chairman (Mr. G. S. Elliott), seconded by Sir Melvill Beachcroft, a resolution was passed expressing regret at Lord Welby's resignation and the Board's deep sense of his services.

The Law and Parliamentary Committee presented a report on the Finance Bill, and, on the recommendation of the Committee, it was agreed, without discussion—"That the Law and Parliamentary Committee be authorized to take such steps as may be necessary with the view of obtaining amendments of the Finance Bill, 1909, to (*a*) clearly define the position of the Board as a 'rating authority,' and (*b*) bring such lands of the Board as are actually being utilized, or in future will be utilized, for the purposes of their undertaking within the exemption contained in clause 25 of the Bill."

The Water Examination Committee reported that the fourth report of the Director of Water Examination (Dr. A. C. Houston) on research work, dealing with the vitality of the cholera vibrio in artificially infected samples of raw Thames, Lea, and New River water, with special reference to the question of storage, was of a reassuring character. It indicated clearly that when samples of river water were stored in the laboratory after being artificially infected with millions of cholera vibrios, the vast majority died within a week. The results strengthened the evidence previously adduced in favour of storage, and appeared to show that by adequate storing of raw impure river waters, before their filtration, the safety of the Metropolis, as regards water-borne epidemic disease, was almost, if not quite, assured.

The return relating to the supply of water for May showed that the average daily quantity sent out was 239,336,000 gallons; the supply per head per day being 33·9 gallons, compared with 32·1 gallons in May last year. The quantity of water in store in impounding reservoirs at the end of the month was 8569 million gallons; the corresponding figure for 1908 being 8011 million gallons.

The Board decided, by a considerable majority, to hold their meetings monthly instead of fortnightly.

A NEW RESERVOIR AT HULL.

The annual visit last Wednesday of the members and officials of the Hull Corporation to the water-works was taken advantage of to perform the opening ceremony in connection with a new reservoir which has just been completed at Keldgate, near Cottingham, at a cost of £43,000. The reservoir, which was designed by the late Water Engineer, Mr. F. J. Bancroft, before he left Hull to go to New Barnet, is founded on the chalk formation, with a top-water level of 140 feet above Ordnance datum. It is constructed of concrete, with a lining of bitumen sheeting; and 361 piers carry the cross walls, from which the arches of the roof spring. The internal dimensions are 324 ft. by 324 ft., and 16 ft. deep. More than 90,000 tons of material were excavated; and about 4000 tons of portland cement were used in the work. The reservoir is supplied with water by a 30-inch branch-main, 2 miles in length, from the Cottingham pumping-station.

Those present at the ceremony included the Mayor and Mayoress (Alderman and Mrs. Feldman), Mr. J. H. Hargreaves (the Chairman of the Water Committee) and Mrs. Hargreaves, and Mr. C. B. Newton (the Water Engineer). They drove to the pumping-station at Springhead, and thence to Keldgate, where they were met by Mr. Shardlow, one of the Directors of Messrs. Moss and Sons, of Loughborough, the Contractors, and Mr. H. Hill, the Clerk of the Works, who conducted them underground and into the empty reservoir, which has a capacity of 10 million gallons. Upon returning to the valve-house, the Mayoress was presented by Mr. Shardlow with a handsome bouquet and a golden key; and she then performed the ceremony of turning on the water. The Mayor said that the object of the reservoir was to make the pressure uniform throughout the 24 hours—to give the same supply during the night as during the day—and thus obviate a good deal of night pumping. The growing demands of the city had rendered the work essential; and it had the entire approval of the Local Government Board. Some 10 acres of land had been purchased by the Corporation, of which the reservoir absorbed 5½ acres; so that a good deal remained in reserve for future extensions. Hull was singularly fortunate in having a supply of water at her very doors; and it was distributed to manufacturers at a price which would compare very favourably with most towns and cities in the kingdom.

The work was named the Keldgate reservoir by Mrs. Hargreaves; and formal votes of thanks were tendered the two ladies who had taken so prominent a part in the day's proceedings. From Keldgate, the party drove to Cottingham, where luncheon was served in the grounds of the pumping-station.

The area of the district supplied by the Hull Corporation is 16,377 acres, or 25·59 square miles, containing a population of 276,750. In addition, the Corporation supply water in bulk to the district of Cottingham, as well as to that of Sutton. The total length of mains on Dec. 31, 1908, was 259 miles; and the quantity of water pumped last year was 3,846,178,000 gallons—the average daily supply for all purposes being 10,421,000 gallons, or 37·65 gallons per head.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the minutes adopted by the Edinburgh and Leith Gas Commissioners at their meeting on Monday last, it was stated that the purchases of coal at the previous meeting amounted to 234,000 tons in all. The Treasurer, Mr. John S. Gibb, laid on the table a copy of the annual accounts; and they were remitted to the Finance Committee. Bailie Inches said that the gross profit on the year's working amounted to nearly 7 per cent. on the capital of the undertaking. From the printed slip that had been circulated by the Treasurer, it would be seen that the Commissioners had more than been able to meet their financial obligations; for, in addition to all the usual charges for interest and sinking fund and other purposes, they had succeeded in providing for a contribution of £10,000 to be placed to the reserve fund, and, further, they had charged to the revenue account a large sum as against the cost of the reconstruction of the general offices. Very little—only £1883—had been added to the capital account of the works and plant during the past year; and it was worthy of announcement that, so far as further capital expenditure was concerned, little, if any, need be expended unless unexpected developments took place in the consumption of gas. Anything that might be required for some years to come would be of the nature of a renewal or replacement, and, as such, was chargeable to the current revenue or to the reserve fund, for which purpose this fund was now being accumulated. With this year's contribution it amounts to £28,688; and as the Commissioners have come under a statutory obligation to contribute annually to this fund to the extent of 2d. per 1000 cubic feet of gas, which is equivalent to (say) £16,000 a year, there is every prospect of the fund being sufficient to meet the ordinary developments of the undertaking. The consumers would no doubt be pleased to learn that the manufacturing costs were such as to warrant the Commissioners reducing the price of gas by 2d. per 1000 cubic feet in the early autumn, which would have the result of taking £16,000 off their next year's gas bills; and the Commissioners were to consider the possibility of making a special rate for gas used in engines. Lord Provost Gibson said they were very much obliged to the Convener for the statement. Provost Smith, of Leith, suggested that a special rate might also be arranged for gas used in heating. The subject was continued for consideration. Mr. Herring, the Gas Engineer, was instructed to make experiments with vertical retorts.

The Directors of the Galashiels Gaslight Company, in their annual report, state a profit for the year of £2150, which, with a reserve fund of £7058, makes a sum of £9208 available for distribution. It is recommended that a dividend of 10 per cent., free of income-tax, be paid, and that the balance of £7108 be placed to the reserve fund. The quantity of gas made during the year was 72 million cubic feet. There was unaccounted-for gas to the amount of 3,537,567 cubic feet; and 720,000 cubic feet were used in the works. The gas accounted for—67,742,433 cubic feet—was 505,417 cubic feet less than in the previous year. The price of gas is to be continued at 2s. 9d. per 1000 feet. The Directors visited the works on Monday, and found them in excellent order.

The report of the Cupar Gas Company, Limited, states that the amount at the credit of the profit and loss account for the year is £1086, exclusive of a balance of £377 brought forward. The Directors recommend dividends at the rate of 5 per cent. on the preference stock, and of 37s. 6d. per share, free of income-tax, on the ordinary stock. They propose to allow £400 for depreciation, and to carry forward £339. It is also recommended that the price of gas be reduced to 3s. 10½d. per 1000 cubic feet on all amounts paid within one month from the date of survey; and that 2½d. per 1000 cubic feet of additional discount be allowed on all ordinary accounts of £15 and upwards per annum.

At the Inverkeithing Town Council last night, a Committee reported having considered letters from the Gas Company offering to sell their undertaking to the Council for £2500, and that they were of opinion that the price named was out of the question. They recommended that the Council decline to entertain the proposal. Provost Niven explained that it was not meant that all negotiations should cease. The Company would perhaps alter their figure. The recommendation was adopted.

The Directors' report of the Leslie Gaslight Company shows a profit for the past year of £222. A dividend of 7½ per cent. is provided for. During the year £247 was spent upon repairs to works and plant. A

new gasholder has also been erected, at a cost of £914, to meet the cost of which £1000 was raised on 4 per cent. debentures.

The East Wemyss and Buckhaven Gas Company, Limited, are about to erect a new gasholder, of 100,000 cubic feet capacity. The contract for the work has been let to Messrs. Henry Balfour and Co., Limited, of Leven.

At the annual meeting of the Pittenweem Gaslight Company, the Chairman—Mr. J. Henderson—stated that the year had been rather an adverse one all round, but the Company had maintained their sound financial position in a most marked degree. The funds in hand amounted to £276; and the Directors recommended a dividend at the rate of 10 per cent. It was agreed to retain the price of gas at 4s. 2d. per 1000 cubic feet, and the same rate of hire for meters.

The annual meeting of the Carluke Gas Company, Limited, was held on Monday evening. The report of the Directors stated the profits for the year at £729, and recommended a dividend of 2s., with a bonus of 6d., per share, and the carrying forward of £104. The financial statement showed an income of £3038, and an expenditure of £2309. The Directors' report and recommendations were approved by a majority. The shareholders recommended the Directors to abolish meter-rents.

The Treasurer of the Edinburgh and District Water Trust—Mr. W. Anderson—has prepared the abstract of accounts of the Trust for the year ending at May 15. The income from water-rates was estimated at £171,321; and there had been realized £172,412. The expenditure was estimated at £159,548; the actual expenditure had been £157,815. The capital expenditure for the year amounted to £22,039. At May 15, the total capital expenditure of the Trust had amounted to £2,795,836; and of this sum, £357,803 had been paid off by means of the sinking fund. Among the items of expenditure in the year were: Feu-duties, rents, and taxes, £19,501; interest, £66,976; annuities, £23,575; contribution to suspense account, £14,504; and contribution to sinking fund, £19,543.

On Wednesday, the Corporation of Arbroath paid their first official visit of inspection to the new Noran Water-Works since their opening. At the luncheon, which was provided by the Town Clerk—Mr. W. K. Macdonald—Provost Alexander proposed the toast of "The Water-Works," and Bailie Robertson, the Convener of the Water Committee, in response, said that the construction of the water-works was now completed. The cost of the works was estimated by the Engineer—Mr. C. P. Hogg, C.E., of Glasgow—at £86,000; and the work had been carried out for £88,000. He was happy to say that this year there would be a reduction in the water-rate of 1d. in the pound. The Company pledged the health of the Town Clerk and the Provost.

Mr. Andrew Hogg writes that the report of the Leven and Methil Gas Company, Limited, of which he is Chairman, published in last week's "Notes" is incorrect, and must refer to some other Company. He adds that a correct account of the Company's meeting appeared in the "JOURNAL" for the 22nd ult. (p. 910).

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *July* 3.

During the week the market has continued quiet. On the one hand, buyers have shown little disposition to operate, while, on the other hand, there has not been any pressure to sell. Consequently, the values remain unchanged at £11 2s. 6d. f.o.b. Hull, £11 3s. 9d. to £11 5s. f.o.b. Liverpool, and £11 7s. 6d. per ton f.o.b. Leith. In the forward position, there is no new feature to comment upon; makers still holding out for a substantial premium on the spot prices for distant delivery.

Nitrate of Soda.

This article remains without change at 10s. 3d. per cwt. for ordinary quality, and 10s. 6d. for refined, *ex* store Liverpool.

Tar Products. LONDON, *July* 5.

There has been very little change in the markets for tar products during the past week. Pitch continues firm, and it now remains to be seen whether the market in South Wales will improve, seeing there is not likely to be a coal strike. Creosote is steady, and there have been one or two fresh inquiries for prompt and delivery over the next few months. Benzol is steady, and there are several inquiries for delivery over the next twelve months. Toluol is quiet, and there have been one or two inquiries for forward delivery; but makers do not feel inclined to sell ahead. In solvent naphtha, there is very little further business doing. Crude carbolic is decidedly weak, and business can probably be done on the east coast at 11½d. to 1s.

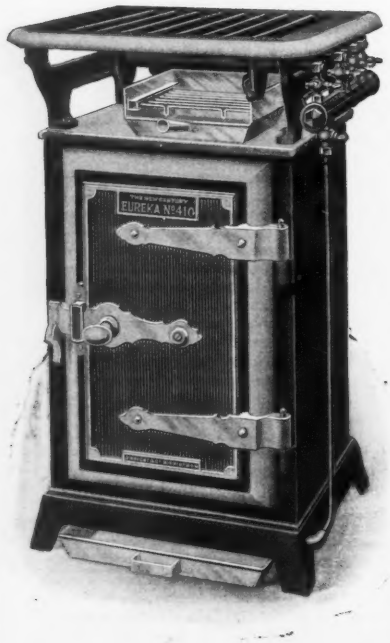
The average values during the week were: Tar, 14s. 6d. to 18s. 6d., *ex* works. Pitch, London, 28s.; east coast, 27s. 6d. to 28s.; west coast, 26s. 6d. to 27s. 6d. f.a.s. Mersey ports, 26s. to 27s. f.o.b. others. Benzol, 90 per cent., casks included, London, 6d. to 6½d.; North, 5¾d. to 6d.; 50-90 per cent., casks included, London, 7d. to 7¼d.; North, 6¾d. to 7d. Toluol, casks included, London, 8¼d. to 8½d.; North, 7¾d. to 8d. Crude naphtha, in bulk, London, 3¼d. to 3½d.; North, 3d. to 3⅛d.; solvent naphtha, casks included, London, 10¾d. to 11¼d.; North, 9½d. to 10d.; heavy naphtha, casks included, London, 10½d. to 11d.; North, 9½d. to 10⅛d. Creosote, in bulk, London, 2⅝d. to 2$\frac{13}{16}$d.; North, 2½d. to 2⅝d. Heavy oils, in bulk, 2⅞d. to 3d. Carbolic acid, 60 per cent., casks included, east coast, 11½d. to 1s.; west coast, 11d. to 11½d. Naphthalene, £4 10s. to £8 10s.; salts, 37s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1¼d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

There is practically no alteration in this article, and the market is certainly quiet. Beckton terms are £11 7s. 6d.; and ordinary makes on Beckton terms, £11 to £11 2s. 6d. Hull is £11 to £11 2s. 6d.; and Liverpool £11 2s. 6d. to £11 3s. 9d. In Leith, the price is £11 6s. 3d. to £11 7s. 6d.

THE "EUREKA" — Highest in Excellence! Lowest in Maintenance Cost!

The "EUREKA."



Machine Tools, made to our own Designs, and perfected by long and numerous tests, have displaced hand labour in nearly every instance in the building up of the **"Eureka."** This has resulted in—

MINUTE MECHANICAL ACCURACY

being secured in the reproduction of all Cooker Parts, and the perfect fit of all parts for renewal is therefore

ABSOLUTELY ENSURED.

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Essex Works,
BIRMINGHAM.

No. 196.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade in the North has been influenced by the crisis in Wales, and prices rose with some sharpness when it was anticipated that there might be a serious stoppage in the production. After the decision in South Wales, prices fell irregularly. Best Northumbrian steams may be quoted at somewhere near 12s. to 12s. 3d. per ton f.o.b.; but a few days will be needed to allow normal conditions to rule. Second-class steams are about 11s. per ton; and steam smalls from 5s. to 6s. In the gas coal trade, there is a steady output, which is well taken up; and, as the period of the smallest home consumption has now passed, and it must soon begin to increase, that production should be met by a rather fuller demand. The gas coal trade did not show the advances in price at the end of June that steam coal knew; and thus there has not been any fall of importance. Durham gas coal varies, according to quality, from about 9s. 9d. to 11s. per ton f.o.b. for the usual classes; and up to 11s. 6d. for "Wear specials." Contracts have been few; but forward orders for moderate quantities are being placed at near current prices, though buyers do not readily give these rates for far forward delivery. In coke, the market is quiet; but gas coke is steady at from about 12s. 6d. to 13s. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade is quieter; the belief gaining ground that the differences between masters and men will be got over without resort to a strike. The rush to obtain additional supplies has therefore lessened. The eight-hours day is now being worked. As yet, however, its effect upon prices is not apparent. The quotations are: Ell 9s. 9d. to 11s., splint 10s. 3d. to 10s. 6d., and steam 9s. to 9s. 3d. per ton f.o.b. Glasgow. The shipments for the week amounted to 360,028 tons—an increase of 10,437 tons upon the previous week, and of 19,578 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,047,478 tons—an increase of 522,197 tons upon the corresponding period.

Assessment of the Honor Oak Reservoir.—It was agreed last Friday that the new Honor Oak reservoir, which is in the borough of Camberwell, should be assessed at a rateable value of £7886. The Borough Council thus secure one ratepayer whose annual contribution will come to nearly £3000.

Water Diviner's Successes.—Mr. H. W. Golding, the Chairman of the Bocking Rural District Council, who has taken up water divining as a hobby, has had some striking successes. One of the largest local farmers, after sinking several useless wells, was prevailed upon to consult Mr. Golding. At one place which the latter indicated, a spring was found at 30 feet below the surface, and at another an almost unlimited supply of water was struck.

The Calcutta Lighting Contract.

The "Statesman" newspaper (Calcutta), of the 15th ult., published the following: At their meeting last evening, the Special Committee of the Calcutta Corporation appointed to consider and report on matters between the Corporation and the Gas, Tramways, Telephone, and Electric Light Companies considered the question of remuneration to be paid to Mr. Mansfield, the gas expert, for his work in regard to the testing of the lights, and for his advice on various matters in dispute between the Gas Company and the Corporation in connection with the lighting of the city. The Committee resolved to recommend to the Corporation for sanction that a sum of 1000 guineas be paid to Mr. Mansfield for his entire services in connection with the gas contract. Mr. Mansfield had applied for this amount being granted to him as remuneration; and his request was supported by the Chief Engineer.

Natural Gas in Canada.—The Canadian Agency in London have received a despatch from Edmonton, Alberta, stating that, after several years of unsuccessful endeavour, natural gas has been struck at Calgary, at a depth of about 2800 feet. The well is said to be flowing at the rate of a million cubic feet per day. The despatch adds that it is still too early to pronounce with certainty on the permanence of the supply; but, judging from experience at some of the large wells in the east of the province, the present strike is a very important one.

Unwholesome Water at Wickham.—It having been ascertained by the Rural District Council at Fareham that 51 houses were receiving unwholesome water at Wickham, the Clerk was instructed to communicate with the owners with the view of their taking supplies from the mains of the Gosport Water Company, which now pass through the district. As to analyzing the water, the Local Government Board have informed the Council that the cost must be borne by them, and not by the owners. The water at Wickham is obtained partially from wells and partially from the river and streams, which have the reputation of being infected.

Liquidation of Moffat's Limited.—At an adjourned meeting of the creditors of Moffat's Limited, held last Thursday, the Liquidator (Mr. R. H. Nerney) stated that the total assets amounted to £25,968, including £13,887 for goodwill and patents. He estimated that there was at present a surplus of £9431. It had been anticipated that the Liquidator would put before the creditors a scheme of reconstruction; but Mr. Nerney stated that he was not in a position to make any statement. Some dissatisfaction was shown that he was unable to report more definitely, after having had a month in which to arrange matters. An opinion was expressed that a joint Liquidator should be appointed to act with Mr. Nerney on behalf of the trade creditors; it was eventually resolved to appoint a Committee, consisting of the four largest trade creditors, to confer with the Liquidator and report to the general body of creditors from time to time.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. *General Offices and Works:* **Warrington.**

Sales of Shares.—Last Tuesday, Messrs. E. J. Brooks and Son sold £100 of ordinary stock of the Oxford Gas Company for £126 10s.; and £100 of preference stock of the same Company for £114. On Thursday, Mr. A. G. Brown sold two fully-paid £25 shares in the Oundle Gas Company at £52, four at £55, and two at £56.

Gas v. Steam for Pumping.—At the last meeting of the Epsom Urban District Council, the Water Committee reported that the Consulting Engineer stated that the total cost of pumping by steam for the year ended March 31, 1907, was £1295, and by suction gas for the year ended March 31 last, £923. This showed a saving of £372; and he added that, if all the water could have been pumped by the gas plant, a further £142 would have been saved.

New Joint-Stock Companies.—The British Patent Oxide Company, Limited, has been formed with a capital of £12,000 in £1 shares, to acquire and turn to account certain patents for inventions relating to the making of red oxide of iron and other substances, &c., and to adopt an agreement with J. Gill. The Carbide Trading Company, Limited, has been formed with a capital of £20,000, in £1 shares, to carry on the business of dealers in carbide of calcium and bye-products and chemicals of all kinds, &c.

Suicide of a Former Gas Official.—A Coroner's Jury at Swindon last week returned a verdict of "Suicide while insane" in the case of Mr. John Wynn, a well-known resident of the town, whose decapitated body was found on the Great Western Railway. No light was thrown on deceased's movements immediately before the occurrence; but Dr. Maclean said he had been attending him for eighteen months for nervous debility and insomnia of an aggravated nature. Mr. Wynn, who was about 54 or 55 years of age, formerly resided in America, and was for some time agent for the New York Life Assurance Company. Previously he had been with the Cheltenham Gas Company, and also with a gas engineering firm at Warrington. He leaves a widow (who is an invalid) and three grown-up children. Deceased was at one time proprietor of the Dumfries Hotel, St. Mary Street, Cardiff.

Suicides by Coal Gas.—Last Wednesday, an inquest was held on the body of Henry James Fuller (60), a retired Liverpool clothier, who was found on the previous morning dead in the bath-room in the house where he lodged in Chester. Deceased had suffered from paralysis, for which he had been medically attended. When found by the police, he was lying with his head and neck supported by a bundle of cloth. The end of an india-rubber tube connected with the gas-bracket was in his mouth, and his head and face were covered with a coat. The window was closed and the door stopped up with a towel. The Jury returned a verdict to the effect that deceased committed suicide by inhaling coal gas, and that he was of sound mind at the time. A man named Sanderson (47), a labourer residing at Prince's Street, Hull, was found last Friday morning lying upon a couch in his room quite dead. His head was in a pillow-case in which was the end of a tube fixed to a gas-bracket fully turned on. Deceased had been drinking heavily. There was every appearance of determined suicide.

Plymouth Water Supply.—The members of the Plymouth Corporation and the officials recently paid a visit to the water-works, and carried out the time-honoured ceremonies connected with the "fyshinge feaste." As usual, a luncheon followed the gathering at the storage reservoir, where the memory of Sir Francis Drake was drunk in the water which he gave to Plymouth. Alderman R. W. Winnicott, the Chairman of the Water Committee, in reviewing the progress of the undertaking, said it was eleven years since the Burrator storage reservoir was built. Since that time, the mains had increased by 25 miles, and their length was now 135½ miles; while the number of supplies had risen from 16,500 to 20,830. The water revenue had grown from £23,299 to £32,440, and the gross profit from £12,119 to £22,763. It was estimated that this year the sum of £6038 would be paid in relief of the rates, compared with £3211 ten years ago. A gratifying feature was the fact that the consumption of water per head had been reduced from 46·43 gallons to 38·04 gallons, which was equal to a saving of more than a million gallons per day. If the waste had not been checked, they would have had to lay another pipe to carry the water to the town; and if they were to postpone the expenditure on an additional main, the efforts for the prevention of waste must be continued. They were indebted to the Water Engineer (Mr. F. Howarth, M.Inst.C.E.) for much good work in this and other directions.

APPLICATIONS FOR LETTERS PATENT.

14,441.—Newhouse, W. A., "Flexible metallic tubing." June 21.
14,508.—Ewing, W., "Gas-retorts." June 21.
14,517.—Margreth, J., "Acetylene-burners." June 21.
14,543.—Grono, H., and Stöcker, K., "Coke-quenching apparatus." June 21.
14,702.—Alexander, W., "Rotary pump or blower." June 23.
14,707.—Godelmann, N., "Mantles and supports." June 23.
14,758.—Hibberd, C. E., "Coin-freed mechanism." June 23.
14,775.—Hamilton, J. H., "Internal combustion engines." June 24.
14,863.—Mower, G. A., and Taylor, J. H. M., "Stop and full-way valves." June 26.
14,903.—Stone, S., "Gauges for indicating the quantity of liquid and pressure in reservoirs and the like." June 26.
14,908.—Crossley, K. I., and Atkinson, J., "Governing internal-combustion engines." June 26.
14,909.—Poleschowsky, J., "Gas-burners." June 26.
14,915.—Richmond, W., "Joints or unions for pipes." June 26.
14,938.—Jung, B., "Mantles." June 26.
14,947.—Gutehoffnungshütte, Aktienverein für Bergbau und Hüttenbetrieb, "Gas-producers." June 26.
14,954.—Durand, L. E. A., "Gas-engines." June 26.
14,973.—Blake, E. W., "Gas-regulators." June 26.

We have an extensive Range of Cooking Appliances suitable for Public Institutions, Boarding Houses, Restaurants, etc., etc.

Your Enquiries will be esteemed.

THE PARKINSON STOVE CO., LTD.

(INCORPORATING MAUGHAN'S PATENT GEYSER CO.)

BIRMINGHAM: Stour Street, Spring Hill. **LONDON:** *Offices and Show-Rooms:* **129, High Holborn, W.C.**

At the meeting of the Water Committee of the Oldham Town Council last Wednesday, the General Manager (Mr. A. Andrew) reported that the profit on the undertaking for the year ended March 25 was £7122, compared with £7319 the previous year. The strike in the cotton trade was considered fully sufficient to account for the falling off.

The Highways Committee of the Finchley Urban District Council have received a communication from the Royal Automobile Club with regard to a proposal from the Gaslight and Coke Company to paint with an improved mixture of oil and gas tar for experimental purposes a length of road in the district. The Committee have decided to recommend that the Surveyor (Mr. C. J. Jenkin) be authorized to carry out the experiment in Great North Road. The District Council have had under consideration the question of tar-painting the main roads; but they have refused the terms offered by the Middlesex County Council, on the ground that they are inadequate.

We learn from Messrs. J. & W. B. Smith, of Farringdon Road, E.C., that an eminently successful installation of "Graetzin" high-pressure gas-lamps has just been carried out by the North Middlesex Gas Company on the premises of Freeman, Hardy, and Willis.

Last Friday the Manchester Gas Committee placed their contract for their supply, during the next two years, of North American gas oil for their carburetted water-gas plant. The total ordered is 5 million gallons; and a Manchester paper says the Committee have been able to buy this for £15,000 less than they paid last year.

The Portsea Island Gas Company have received notice from the Admiralty that they intend to resume possession of the entire waterside frontage at Rudmore, at which the coals of the Company have hitherto been landed. The land will be utilized for docking purposes; but the Company are still in a position to receive a full supply of coal at their new works at Hilsea.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

CALORIMETRY OF PRODUCER AND ILLUMINATING GASES.—By JOHN F. SIMMANCE, Assoc. M.Inst.C.E., M.Inst.Mech.E. *Price 2s.*

THE SCIENCE AND PRACTICE OF LIGHTING AS APPLIED TO STREETS, OPEN SPACES, AND INTERIORS.—By W. H. Y. WEBBER. *Price 3s. 6d.*

GAS ENGINEERS' LABORATORY HANDBOOK.—By J. HORNBY. *Price 6s.*

THE VALUATION OF GAS, ELECTRICITY, AND WATER-WORKS FOR ASSESSMENT PURPOSES.—Second Edition. By THOMAS NEWBIGGING, M.Inst.C.E., and WILLIAM NEWBIGGING, Assoc.M.Inst.C.E. *Price 5s.*

REESON'S COMPLETE GAS AND WATER ACTS.—By JOSEPH REESON. *Price 21s.*

MOND GAS SCHEME.—By F. N. KEEN, of the Middle Temple, Barrister-at-Law. *Price 1s.*

NOTES ON THE LITHOLOGY OF GAS COALS, WITH LIST OF COMMERCIAL ANALYSES.—By JAMES PATERSON, C.E., F.G.S. *Price 3s.*

PUBLIC LIGHTING BY GAS AND ELECTRICITY.—By W. J. DIBDIN, F.I.C., F.C.S. *Price 21s.*

CONSTRUCTION OF GAS-WORKS.—By HUGHES and O'CONNOR. *Price 6s.*

GAS, OIL, AND AIR ENGINES.—By (the late) BRYAN DONKIN. *Price 25s.*

GAS LIGHTING.—By CHARLES HUNT. *Price 1s.*

THE FLOW OF GASES AND PROPORTIONING GAS-MAINS.—By F. SOUTHWELL CRIPPS, Assoc. M.Inst.C.E. *Price 7s. 6d.*

GAS AND FUEL ANALYSIS.—By A. H. GILL. *Price 5s. 6d.*

SANDELL'S GAS COMPANIES' EXPENDITURE JOURNAL.—*Price, two quires*, 36s.; *three quires*, 45s.

INTERNATIONAL ENGINEERING CONGRESS (GLASGOW, 1901))—THE PROCEEDINGS OF THE GAS SECTION. Edited by J. W. HELPS, M.Inst.C.E. *Price 5s.*

Other Books supplied (Post Free) at Published Prices.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations, &c., Vacant.

MANAGER AND ENGINEER. Isle of Thanet Gas Company. Applications by July 15.
RETORT-HOUSE FOREMAN. No. 5111.

Situations Wanted.

MANAGER OR ASSISTANT. No. 5112.
SECRETARY, MANAGER, OR ACCOUNTANT. W. B. Mimmack, St. Paul's Cray.
SULPHATE LEADWORK. Leadburner, 117, Gallaway Road, Shepherd's Bush.

Stocks and Shares.

ENFIELD GAS COMPANY. July 13.
EPSOM AND EWELL GAS COMPANY. July 26.
HARROW GAS COMPANY. July 13.

Stocks and Shares—*continued.*

HERTFORD GAS COMPANY. July 13.
WARE GAS COMPANY. July 13.
WEST KENT GAS COMPANY. July 13.

TENDERS FOR

Coal and Cannel.

BELFAST GAS DEPARTMENT. Tenders by July 15.
GOOLE URBAN DISTRICT COUNCIL. Tenders by July 21.
LYMM URBAN DISTRICT COUNCIL. Tenders by July 21.
MALTON GAS COMPANY. Tenders by July 12.
PEMBROKE DOCKS GAS COMPANY. Tenders by July 15.
STRATFORD-UPON-AVON GAS DEPARTMENT. Tenders by August 21.
STRETFORD GAS COMPANY. July 10.

Pipes, &c., and Pipe Laying.

ASHFORD GAS DEPARTMENT. Tenders by July 20.
BETHESDA URBAN DISTRICT COUNCIL. Tenders by July 15.
PRESCOT GAS COMPANY. Tenders by July 13.

Tank (Lead Lined).

CANTERBURY GAS AND WATER COMPANY. Tenders by July 10.

Tar and Liquor.

ALTRINCHAM GAS COMPANY. Tenders by July 14.
COVENTRY GAS DEPARTMENT. Tenders by July 19.
LONGTON CORPORATION. Tenders by July 20.
LYMM URBAN DISTRICT COUNCIL. Tenders by July 21.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 19.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 16	10	Alliance & Dublin 10 p.c.	17½—18	..	5 11 1
298,955	10	,,	7	Do. 7 p.c.	12⅝—13	..	5 7 8
310,000	Stk.	Jan. 14	4	Do. 4 p.c. Deb.	9⅝—100	..	4 0 0
200,000	5	May 27	6⅓	Bombay, Ltd.	5⅛—5⅜	..	5 12 7
40,000	5	,,	6⅓	Do. New, £4 paid	4⅛—4⅜	..	5 18 10
50,000	10	Feb. 25	4	Bourne- } 10 p.c.	28½—29½	..	4 15 9
51,810	10	,,	7	mouth Gas } B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	and Water } Pref. 6 p.c.	15⅝—15⅞	..	3 15 7
380,000	Stk.	,,	12½	Brentford Consolidated	253—256	+1	4 17 8
300,000	,,	,,	5½	Do. New	194—196	..	4 16 11
50,000	,,	,,	5	Do. 5 p.c. Pref.	122 - 124	..	4 0 8
206,250	,,	June 11	4	Do. 4 p.c. Deb.	100 -102	..	3 18 5
220,000	Stk	Mar. 12	10⅔	Brighton & Hove Orig.	212—214	..	5 0 6
246,320	,,	,,	7⅛	Do. A Ord. Stk.	154—156	..	4 19 4
460,000	20	Apl. 16	10	British	44⅜—45⅜	..	4 11 11
109,000	Stk.	Feb. 25	6	Bromley, A 5 p.c.	119—121	..	4 19 2
165,700	,,	,,	4⅓	Do. B 3⅓ p.c.	89 - 91	..	4 18 11
82,278	,,	,,	5⅓	Do. C 5 p.c.	108—110	..	5 0 0
55,000	,,	June 25	3⅓	Do. 3⅓ p.c. Deb.	88—90*	..	3 17 9
500,000	10	May 13	7	Buenos Ayres (New) Ltd.	13⅞—14¼	..	4 18 3
250,000	Stk.	June 25	4	Do. 4 p.c. Deb.	92 -94*	..	4 5 1
100,000	10	—	—	Cape Town & Dis., Ltd.	4½—5	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅛ - 6	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	48 -49	..	6 2 5
100,000	Stk.	June 25	4⅓	Do. 4½ p.c. Deb. Stk.	80 - 82*	+2	5 9 9
157 153	Stk.	Feb. 25	5⅝	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,493,280	Stk.	Mar. 12	5⅗	Commercial 4 p.c. Stk.	108—110	..	4 14 6
560,000	,,	,,	5	Do. 3⅓ p.c. do.	104—106	+1	4 14 4
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	5	Continental Union, Ltd.	96—98	..	5 2 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5	Derby Con. Stk.	121—123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
148,995	,,	Mar. 31	5	East Hull 5 p.c. Ord.	100—102	..	4 18 0
486,093	10	Jan. 28	12	European, Ltd.	24⅜—24⅝	..	4 17 0
354,060	10	,,	12	Do. £7 10s. paid.	18⅝—19	..	4 14 9
15,161,545	Stk.	Feb. 11	4/10/8	Gas } 4 p.c. Ord.	103 -104	..	4 7 0
2,600,000	,,	,,	3⅛	light } 3⅛ p.c. max.	88—89	..	3 18 8
3,799,735	,,	,,	4	and } 4 p.c. Con. Pref.	105—107	..	3 14 9
4,193,975	,,	June 11	3	Coke } 3 p.c. Con. Deb.	54 -56	..	3 9 9
258,740	Stk.	Mar. 12	4⅜	Hastings & St. L. 3⅛ p.c.	93—95	..	5 0 0
82,500	,,	,,	6¼	Do. do. 5 p.c.	118—120	..	5 4 2
70,000	10	Apl 29	11	Hongkong & China, Ltd.	17⅛ -18	..	6 2 3
123,500	Stk.	Mar. 12	6⅓	Ilford A and C	141 -143	+1	4 10 11
65,780	,,	,,	5	Do. B	106—108	..	4 12 7
63,000	,,	June 25	4	Do. 4 p.c. Deb.	102 -104*	+2	3 16 11
4,940,000	Stk.	May 13	8	Imperial Continental	179—181	..	4 8 5
473,600	Stk.	Feb. 11	3⅛	Do. 3⅛ p.c. Deb. Red.	95—97	..	3 12 2

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Mar. 12	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	Feb. 25	10	Liverpool United A	226—228	..	4 7 9
718,100	,,	,,	7	Do. B	168—170	..	4 2 4
306,083	,,	June 25	4	Do. Deb. Stk.	103—105*	..	3 16 2
25,000	5	June 11	6	Malta & Mediterranean.	4⅜—5	—⅛	6 0 0
560,000	100	Apl. 1	5	Met of } 5 p.c. Deb.	100—102	..	4 18 1
250,000	100	,,	4⅓	Melbourne } 4⅓ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 27	3⅓	Monte Video Ltd.	12½—13	..	5 7 8
1,775,892	Stk.	Feb. 25	4⅓	Newc't e & G't sh'd Con.	106⅛—107⅛	..	4 3 9
518,795	Stk.	June 25	3⅓	Do. 3⅓ p.c. Deb.	91—92	+½	3 16 1
15,000	10	Feb. 25	10	North Middlesex 10 p.c.	19⅜—20	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	13—13⅜	..	5 3 8
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Mar. 31	8	Ottoman, Ltd.	6⅛—6⅜	+⅛	6 5 6
31,800	53	Feb. 25	13	Portsea Island A.	137—139	..	4 19 0
60,000	50	,,	13	Do. B.	129—131	..	4 19 3
100,000	50	,,	12	Do. C.	119—121	..	4 19 2
114,800	50	,,	10	Do. D and E.	101—103	..	4 17 1
398,490	5	May 13	7	Primitiva Ord.	6⅜—7	..	5 0 0
796,585	5	Jan. 28	5	Do. 5 p.c Pref.	5⅛—5⅜	..	4 10 11
485,900	100	June 1	4	Do. 4 p.c Deb.	94—96	..	4 3 4
1,000,000	10	Apl 29	8	River Plate Ord.	14⅞—15⅛	..	5 4 11
312,650	Stk.	June 25	4	Do 4 p.c. Deb.	90—58*	+3	4 1 8
250,000	10	Mar. 31	8	San Paulo, Ltd.	4 -14⅜	..	5 10 4
62,500	10	,,	6	Do 6 p.c. Pref.	12—12⅜	+⅛	4 16 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49½—50⅜*	+⅛	4 19 0
135,000	Stk.	Mar. 12	10	Sheffield A	236—238	..	4 4 0
209,984	,,	,,	10	Do. B	233 —235	..	4 5 1
523,500	,,	,,	0	Do. C	233 —235	..	4 5 1
70,000	10	June 11	10	South African	13⅜—14	..	7 2 10
6,429,895	Stk.	Feb 11	5/6/8	South Met., 4 p.c. Ord.	122—124	..	4 6 0
1,895,445	,,	Jan. 14	3	Do. 3 p.c. Deb.	85—86	..	3 9 9
209,820	Stk.	Mar. 12	8	South Shields Co. Stk.	152—154	..	5 3 11
605,000	Stk.	Feb. 25	5½	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	22—124	..	4 0 8
117,058	,,	Jan. 14	5	Do. 5 p.c. Deb. Stk.	124—126	..	3 19 4
502,310	Stk.	May 13	5	Southampton Ord.	110—112	..	4 9 3
120,000	Stk.	Feb. 25	6⅔	Tottenham } A 5 p.c.	132 -134	..	5 0 9
423,940	,,	,,	5⅓	and } B 3⅓ p.c.	111 - 113	..	4 12 11
149,470	,,	June 25	4	Edmonton } 4 p.c. Deb.	59 -101*	..	3 19 3
182,380	10	June 11	8	Tuscan, Ltd.	9 - 9⅜	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	99—101*	+⅛	4 19 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p.c. max.	109—111	..	4 10 1
255,636	Stk.	Feb. 25	6⅓	Wands- } B 3⅓ p.c.	139—141	..	4 12 2
79,416	,,	June 25	3	worth } 3 p.c. Deb. Stk.	73—75*	..	4 0 0
895,872	,,	Feb. 25	5½	West Ham 5 p.c. Ord.	121—123	..	4 5 4
210,000	,,	,,	5	Do. 5 p.c. Pref.	126—128	..	3 18 2
253,300	,,	June 25	4	Do. 4 p.c. Deb. Stk.	105—107*	..	3 14 9

Prices marked * are "Ex div."

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

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O'NEILL'S OXIDE

For GAS PURIFICATION.

LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD., PALMERSTON HOUSE, OLD BROAD STREET, LONDON, E.C.

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"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

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See Advertisement on p. 1.

FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

BROTHERTON & CO., LIMITED.

Offices: City Chambers, LEEDS.

Correspondence invited.

APPLY TO THE

CHAIN BELT ENGINEERING CO.

DERBY, ENGLAND,

FOR REALLY HIGH-CLASS

ELEVATORS AND CONVEYORS

ALSO

DRIVING AND CONVEYOR CHAINS.

TAR WANTED.

National Telephone 7002. Telegrams: "UPRIGHT."

Apply, **THOMAS HORROCKS**

Albert Chemical Works, BRADFORD, MANCHESTER.

Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Sulphate of Ammonia.

AMMONIACAL Liquor wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

"HALLITE" Asbestos High-Pressure Sheeting.

HALLITE DOUGLAS, LIMITED, 106, Leadenhall Street, LONDON, E.C.

"NUGEPE" GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,

LOWER MOSS LANE, MANCHESTER, S.W.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.

We guarantee promptness, with efficiency for Repairs.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

Telegrams: SATURATORS, BOLTON. Telephone 0848.

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ANY QUANTITY. ANY PORT. ANY STATION.

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J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 25, BRIDGE END, LEEDS.

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BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.

BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

TO Gas Managers, &c., Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes, and if Wets or Drys. Scrap Metals, Drosses, Metal Shop Sweepings, &c., also bought.

J. WILSON, Pleasant Grove, York Road, King's Cross, LONDON, N.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by

CHANCE AND HUNT, LIMITED,

Works: OLDBURY, WEDNESBURY, AND STAFFORD.

Address Correspondence and Inquiries to OLDBURY, WORCS.

Telegrams: "CHEMICALS, OLDBURY."

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.

It is also used for the enrichment of Gas.

Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.

Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

AMMONIACAL Liquor wanted.

CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

Telegrams: "CHEMICALS."

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PAINT FOR GAS-WORKS.

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5, CROOKED LANE, LONDON, E.C.

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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.

SPENCER CHAPMAN & MESSEL, LTD.,

with which is amalgamated WM. PEARCE & SONS, LTD. 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."

Telephone: 341 AVENUE.

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MOVEMENTS FOR CLOCKS, PHOTOMETERS AND BAROGRAPHS, WHEELS, PINIONS AND WORMS.

WORKS, HANDSWORTH, BIRMINGHAM.

AMMONIA.

Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

FIDDES-ALDRIDGE

SIMULTANEOUS Discharging-Charger.

The one Machine which Discharges and Charges at One Stroke.

See Advertisement, June 22, p. VI. of Centre.

ALDRIDGE AND RANKEN,

39, VICTORIA STREET, WESTMINSTER, S.W.

Telegrams: "MOTORPATHY, LONDON." Telephone: 5118 WESTMINSTER.

D. ANDERSON AND COMPANY,

GAS LIGHTING ENGINEERS AND CONTRACTORS,

18 & 20, FARRINGDON ROAD, LONDON, E.C.

Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Thornhill, DEWSBURY.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

MR. W. B. MIMMACK, for many years Secretary, Manager, and Accountant of the Crays Gas Company (111 Millions), now in Amalgamation, seeks APPOINTMENT in any or all of these Offices.

St. Paul's Cray, KENT.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

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PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
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arranged effectively. Greatly appreciated by Recipients. Numerous unsolicited Testimonials. Write Now for Particulars.
Herbert Greatorex, Birchover, Matlock.

SULPHATE Leadwork, Repairs,
Alterations, New Saturators by a Journeyman PLUMBER of Great Experience. Worked at Beckton, Sheffield, Dublin, &c. Work Guaranteed and at lowest possible Prices. Own Plant. Any Distance for Odd Work. Day or Contract.
Leadburner, 117, Gallaway Road, Shepherd's Bush, London.

WANTED, by an Engineer (Age 29)
Situation as MANAGER or ASSISTANT. Trained in Large Works, and held position of Manager of Small Works. Thoroughly familiar with duties appertaining to Works and Offices.
Address No. 5112, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

RETORT-HOUSE Foreman required in
a London Gas-Works. Three Millions daily. Must have had good Experience of Gibbons Single-Fire Regenerator Settings and be a thoroughly good Carbonizer. Previous Experience as Foreman absolutely necessary. One engaged in large Works making big makes per Ton preferred. Good recent Testimonials required. Eight hours. Wages, 45s. to 47s. 6d. weekly, according to abilities.
Apply, by letter, to No. 5111, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

THE Directors of the above Company
are prepared to receive APPLICATIONS for the Appointment of MANAGER and ENGINEER.
The make of Gas last Year was 315 Millions.
Candidates must possess a thorough knowledge of the Manufacture and Distribution of Gas in all its Branches, the Working of Inclined Retorts, Manufacture of Sulphate of Ammonia, and a thorough knowledge of the Commercial Management of a Gas-Works.
Salary, £365 per Annum, inclusive.
Age 30 to 40. Total Abstainer preferred.
Applications, in Candidates own Handwriting, stating Experience, and enclosing *copies* of Testimonials (which will *not* be returned), to be sent to these Offices addressed to the Chairman not later than Thursday, July 15, 1909.
Canvassing directly or indirectly will disqualify.
By order,
Thos. Fuller, F.C.I.S.,
Secretary.
Company's Offices, Addington Street, Margate, July 2, 1909.

PURIFIERS—Set of Four, 12 feet
Square, fixed complete, £300. A bargain. Also Four 6 feet Square, Two 8 feet, Four 8 feet, and Two 12 feet square PURIFIERS. Cheap.
Firth Blakeley's, Thornhill, Dewsbury.

GASHOLDERS—Splendid, 45 feet diameter, and New STEEL TANK fixed complete, £600 to Plan and Specification. Also 50 feet Single-Lift and 50 feet Double-Lift. Cheap, with STEEL TANKS. Can be seen temporarily erected.
Firth Blakeley's, Thornhill, Dewsbury.

WASHERS and Scrubbers — Two
"Livesey" WASHERS. One "Clapham" WASHER. TOWER-SCRUBBERS, 3 ft. 6 in. by 16 ft., 4 ft. by 16 ft., and 7 ft. diameter by 55 ft. high. Sold at Bargains, being overstocked.
Firth Blakeley's, Thornhill, Dewsbury.

CONDENSERS—Clapham's, also Cutler's
Water-Tube CONDENSERS. Pipe CONDENSERS, 4-inch to 10-inch diameter. Annular CONDENSERS, 8-inch, 10-inch, and 12-inch. Erected Complete and Cheap.
Firth Blakeley's, Thornhill, Dewsbury.

STATION Meters and Governors—
Several in Stock, 4-inch to 18-inch, with New Drums. Prompt Execution.
Firth Blakeley's, Thornhill, Dewsbury.

PUMPS, Tanks, &c.—Two and Three-
throw PUMPS, Belt or Steam Driven, and Single and Double-acting Verticals and Horizontals. Large Stock of Tanks and all Sundries.
Firth Blakeley's, Thornhill, Dewsbury.

CANTERBURY GAS AND WATER COMPANY.

TENDERS are invited for one Cast-Iron
TANK, 15 ft. by 5 ft. by 5 ft. deep, with outside faced Flanges, lined with ¼-inch pure Chemical Sheet Lead, Delivered and Erected Complete at these Works, for the Storage of Sulphuric Acid.
Further Particulars, if required, may be had from the Company's Engineer.
Tenders to be sent in on or before Saturday, the 10th of July, 1909.
James Burch,
Secretary and General Manager.

BOROUGH OF LONGTON.

THE Gas and Electricity Committee
invite TENDERS for the Surplus TAR produced at these Works during the Year ending June 30, 1910.
Further Particulars may be obtained on Application to the undersigned.
Tenders, endorsed "Tender for Tar," to be sent in addressed to the Chairman of the Gas and Electricity Committee not later than Tuesday, July 20, 1909.
W. Langford,
Engineer and General Manager.
Gas and Electricity Works, Longton.

ALTRINCHAM GAS COMPANY.

TENDERS FOR TAR.

THE Directors invite Tenders for the
Surplus TAR produced at their Works between July 1, 1909, and June 30, 1910.
Estimated Quantity, 1100 Tons.
Delivery, at the option of the Gas Company, either into Contractor's Tank-Waggons or Gas Company's Tank-Waggons at Altrincham Station, or in Contractor's Barrel Carts at the Gas-Works, and separate Prices to be given in each case.
Sealed Tenders, addressed to the Chairman, and endorsed "Tender for Tar," to be delivered not later than Noon on Wednesday, July 14.
J. E. Lamb,
Manager.
Gas Office, Altrincham, June 29, 1909.

BETHESDA URBAN DISTRICT COUNCIL.

THE Bethesda Urban District Council
invite TENDERS for the Supply of MATERIALS and EXECUTION OF WORK required in Connection with the LAYING of about 3000 Yards of GAS-MAINS, and the addition of 50 STREET LAMPS.
Plans and Specifications may be inspected at my Office during Office hours (Ten a.m. to Five p.m.) from July 7 to 11 inclusive.
A Copy of the Specifications will be forwarded to Firms proposing to Tender on receipt of a Deposit of 10s. 6d. which will be returned on receipt of a *bonâ-fide* Tender.
The Council do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Gas-Mains Extension," to be delivered to me not later than Ten a.m. July 15, 1909.
(Signed) D. Griffith Davies,
Clerk.
Council Offices, Bethesda, July 3, 1909.

URBAN DISTRICT COUNCIL OF LYMM.

THE above Council are prepared to
receive TENDERS for the Supply of CANNEL and Best Screened GAS COAL, to be delivered at their Gas-Works in Lymm, for a term of Twelve Months from the 1st day of September, 1909.
The probable Quantities required will be about 300 Tons of Cannel and about 2000 Tons of Gas Coal, which must be Freshly-Wrought, well-Screened, and free from Sulphurous Pyrites and other objectionable matter; but the Council reserve the right of increasing or decreasing the Quantities named.
The person whose Tender is accepted will be required to enter into an agreement with the Council for the due performance of his Contract.
Sealed Tenders, stating Price per Ton delivered by Boat alongside the Works, to be sent to the undersigned on or before the 21st of July, 1909, and endorsed "Coal Tender."
The Council do not bind themselves to accept the lowest or any Tender.
Forms of Tender are not Supplied.
Further Particulars may be had on Application to the Gas Manager, Mr. W. L. Donaldson.
W. Mullard,
Clerk.
Council Offices, Lymm, Cheshire, June 30, 1909.

TAR AND AMMONIACAL LIQUOR.

THE Lymm Urban District Council are
prepared to receive TENDERS for the Purchase of the Surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One Year from the 1st day of September, 1909 (or for such longer term as may be contracted for with the consent of the Council).
Tar and Liquor will be delivered free into Contractor's Boat on the Bridgwater Canal.
Tenders to be sent to the undersigned on or before the 21st day of July, 1909, endorsed "Tar."
The purchaser will be required to enter into an Agreement with the Council for the due performance of his Contract.
The Council do not bind themselves to accept the highest or any Tender.
Forms of Tender are not Supplied.
Further Particulars may be had on Application to the Gas Manager, Mr. W. L. Donaldson.
W. Mullard,
Clerk.
Council Offices, Lymm, Cheshire, June 30, 1909.

THE Prescot Gas Company invite
TENDERS for the Supply of the following GAS-MAINS—namely:
7000 Yards of 4-inch.
800 Yards of 3-inch.
1300 Yards of 2-inch.
Full Particulars and Specification can be had on Applying to the undersigned.
Tenders to be sent in on or before the 13th of July inst.
John E. Hall,
Engineer and Manager.
Gas-Works, Prescot, June 29, 1909.

TENDERS FOR COAL.

THE Directors of the Malton Gas Com-
pany invite TENDERS for a Supply of BEST GAS NUTS, to be delivered at the Coal Depôt of the North Eastern Railway Company, Malton, in the Twelve Months ending June 30, 1910. Quantity, 4000 to 5000 Tons.
Forms of Tender and Particulars may be obtained from the undersigned.
Tenders to be sent in on or before Monday, the 12th of July inst.
The lowest or any Tender not necessarily accepted.
Henry Tobey,
Secretary.
Gas Office, Malton.

CITY AND COUNTY BOROUGH OF BELFAST.

THE Gas Committee of the Corporation
invite TENDERS for the Supply of 105,000 Tons of Best Screened GAS COAL, to be delivered free, and trimmed, in Barges at Belfast Harbour, between the 1st of October, 1909, and the 30th of September 1910.
No Tender for less than 10,000 Tons will be considered.
Monthly Quantities and Particulars may be obtained from the undersigned.
Tenders, on Office Forms, endorsed "Tender for Coal," addressed to the Town Clerk, Belfast, will be received up till and including the 15th of July, 1909.
The lowest or any Tender not necessarily accepted.
Robert Sharpe,
Engineer and Manager.
Gas-Works, Belfast.

THE Gas Committee of the Coventry
Corporation invite TENDERS for the Purchase of Surplus TAR produced at their Gas-Works for the Twelve Months commencing Aug. 1 next.
Estimated Quantity of Surplus Tar, 3500 Tons.
Form of Tender and Conditions of Contract may be obtained on Application to the undersigned.
The Committee do not bind themselves to accept the highest or any Tender.
Sealed Tenders, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, endorsed "Tender for Tar," must be delivered not later than Nine a.m., on Monday, the 19th inst.
Fletcher W. Stevenson,
Engineer and General Manager.
Gas-Works, Coventry, July 1, 1909.

ASHFORD URBAN DISTRICT COUNCIL.

THE Gas Committee of the above
Council are prepared to receive TENDERS for the Supply of about
1800 Yards of 6-inch CAST-IRON MAIN.
2000 " 4-inch " "
750 " 3-inch " "
Full Particulars may be obtained from the under signed.
Endorsed Tenders to be delivered not later than the 20th of July, 1909, to the Clerk to the Council, 11, Bank Street, Ashford.
The lowest or any Tender not necessarily accepted.
H. R. Turner,
Engineer and Manager.
Gas-Works, Ashford, Kent, June, 1909.

TENDER FOR COAL.

THE Directors of the Pembroke Docks
and Town Gas Company invite TENDERS for the Supply of 3000 Tons of Best Screened GAS COALS or NUTS for the Year ending Aug. 31, 1910, to be delivered at the Great Western Railway Jetty, Hobbs Point, Milford Haven. Steamboats of 400 to 500 Tons burden can be discharged at this pier in from Two to Three Days.
Sealed Tenders, endorsed "Tender for Coal," to be addressed to the Secretary, 4a, Lion Street, Brecon, on or before July 15, 1909.
Further Particulars can be obtained from the undersigned.
A. Horace Brookman,
Manager.
Gas Offices, Pembroke Dock, June 21, 1909.

STRETFORD GAS COMPANY.

THE Directors of the Stretford Gas
Company invite TENDERS for the Supply of Unscreened GAS COALS, NUTS, SLACK, and CANNEL, to be delivered at the Gas-Works, Stretford, on the Bridgewater Canal, or at Stretford Station (M. S. J. & A. Railway) during the next One, Two, or Three Years, in monthly Quantities as may be required, commencing Aug. 1, 1909.
The Tenders must state:
Price per Ton in Waggons at Pit.
Railway or Canal Rate to Stretford.
Waggon or Boat Hire to Stretford.
Tenders to be delivered to the Gas-Works, Stretford, not later than noon on Saturday, the 10th of July, 1909, endorsed "Tender for Coal, &c.," and addressed to the Chairman of the Company.
The Directors do not bind themselves to accept the lowest or any Tender.
Forms of Tender can be obtained on Application to the undersigned.
By order of the Board,
Benjamin Haynes,
Secretary.
Stretford, June 19, 1909.

STRATFORD-UPON-AVON CORPORATION.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of 6000 Tons of Good Screened GAS COAL or NUTS, for delivery during the Twelve Months ending Sept. 30, 1910.

Forms of Tender and other Particulars can be obtained upon Application to the Engineer and Manager.

Tenders to be sent in (and will be accepted only on the Forms supplied) not later than Aug. 21, 1909.

The lowest or any Tender not necessarily accepted.

J. S. CRANMER,
Engineer and Manager.

July, 1909.

GOOLE URBAN DISTRICT COUNCIL.

TENDERS are invited for the Supply of about 8000 Tons of GAS COAL and 700 Tons of STEAM COAL.

Particulars and Form of Tender may be obtained on Application to the Undersigned.

Tenders, endorsed "Tender for Coal," and addressed to the Chairman, Gas and Water Committee, Gas-Works, Goole, to be delivered not later than the 21st day of July, 1909.

W. A. BURTON,
Engineer and Manager.

Gas-Works, Goole,
June 30, 1909.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Trustees of William Hobbs, decd.; the Administrator of Mrs. Adelaide Overell, decd.; and other Owners.

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MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, July 13, at Two o'clock, in Lots.

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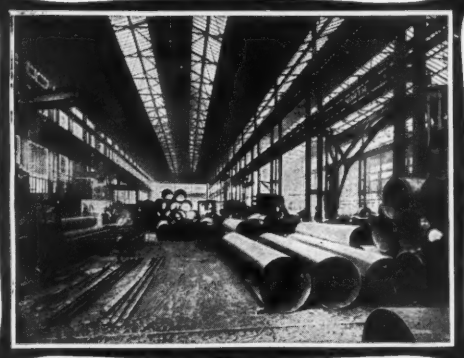

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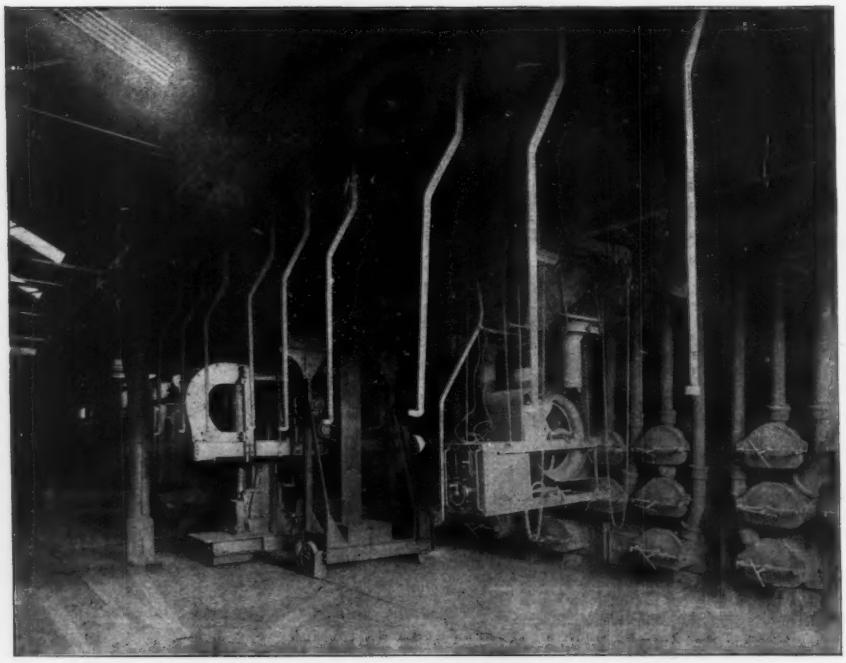

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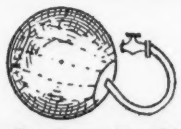

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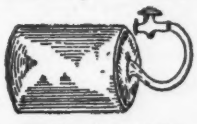

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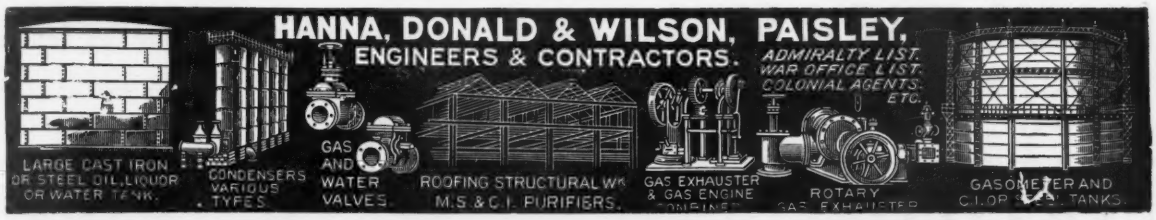

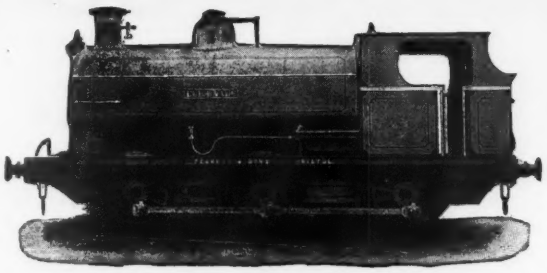

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SPLENDID CARBONIZING RESULTS.

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Reference can be given to several Works where Regenerators are still working after a life of 10 to 15 Years.

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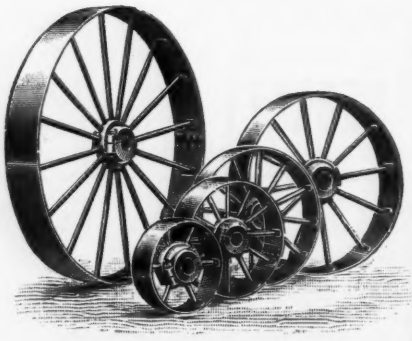

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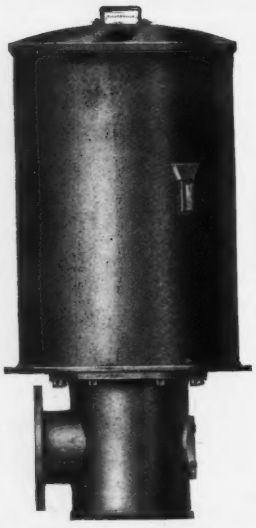

RETORT HOUSE GOVERNORS.

THESE Governors are made to prevent fluctuation in the Pressure of Exhaust in the Hydraulic Main by controlling the Gas entering the Governor, notwithstanding the constant varying quantity of Gas coming from the Retorts. This enables the Seal of the Dip Pipes to be reduced to a minimum with perfect safety, and an increase in the make of Gas per Ton of Coal is thereby assured.

There is absolutely no possibility of any sticking, due to deposits of Tar or Pitch, with this Governor, as the Cone is quite free to pass through the Seat. The Regulation by means of a long Parabolic Cone is recognized as the most exact method that can be employed. A great improvement, first introduced by Messrs. JAMES MILNE & SON, LIMITED, is the simple arrangement by which a smaller Cone and Seat can be easily fitted, thus ensuring delicate adjustment during a period of small makes.

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Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

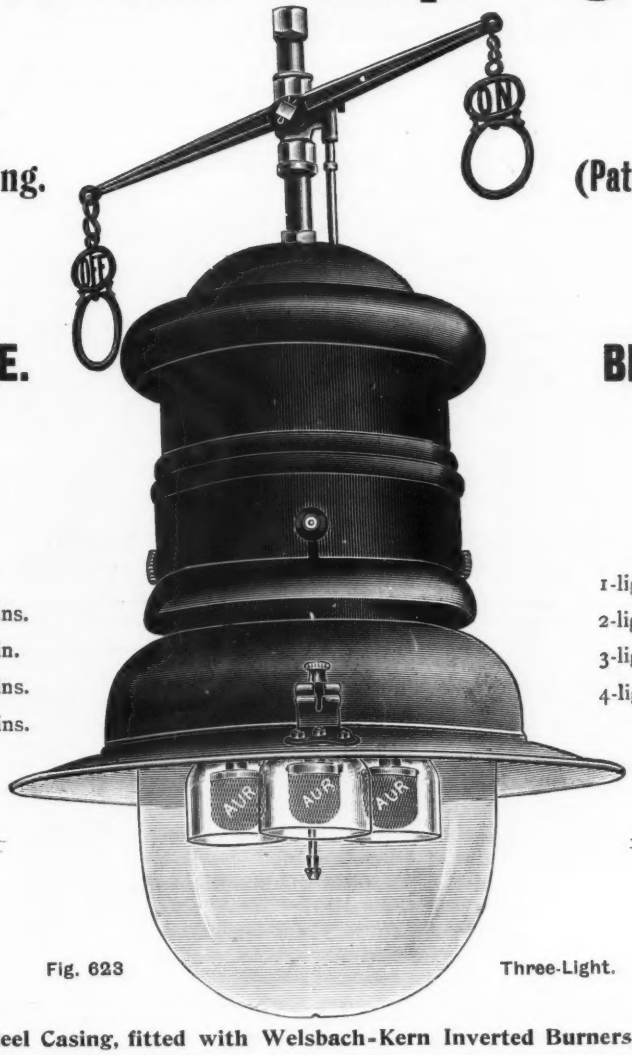

Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 1 in.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 4 ins.
3-light . . .	1 ft. 6 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**4/-**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**42/9**	**57/9**	**93/-**
Case contains . .	*80*	*48*	*18*	*12*

		1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra	each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra	"	**3/6**	**6/-**	**7/6**	Not made.

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

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CARBONIZATION MADE EASY.

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Carbonizing charges **40 per cent. less** than with Horizontals.
No skilled Stokers necessary.
Yield of Gas per ton guaranteed about 1000 cubic feet more than under present conditions, of guaranteed candle power.

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More liquid Tar.
Stopped Pipes unknown.

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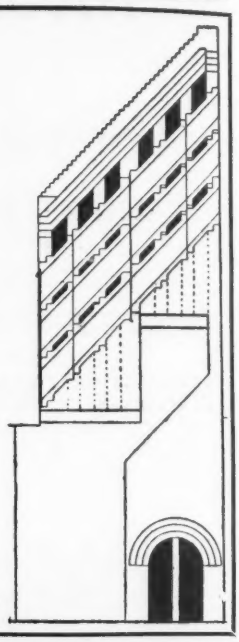

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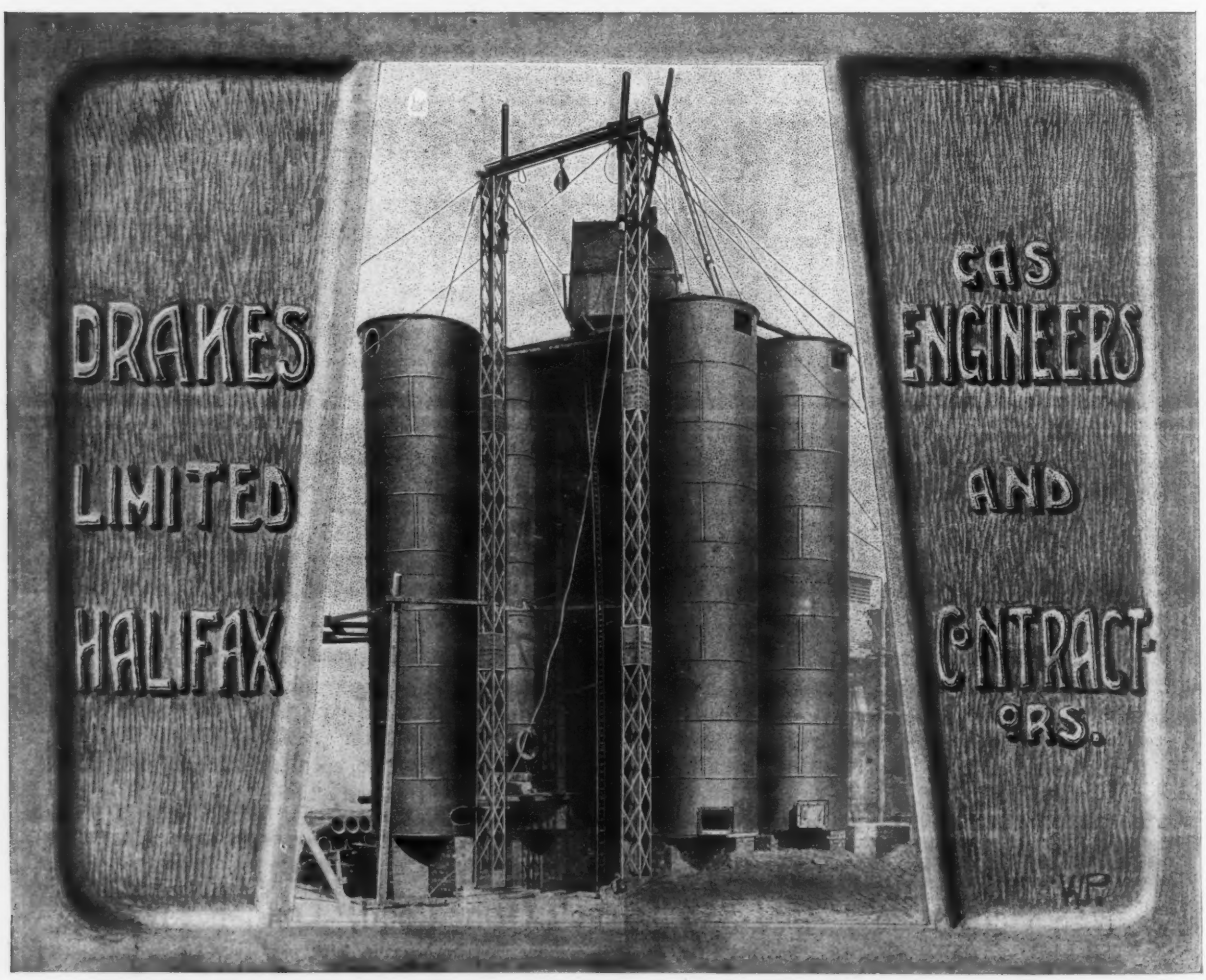

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The New Smokeless Fuel.

Why Gas Companies should adopt the above Process:—

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ARROL-FOULIS
Stoking Machinery
HYDRAULIC COKE PUSHERS
(HUNTER and BARNETT'S PATENT).
WILL DISCHARGE A RETORT IN ONE OPERATION
LARGE NUMBERS IN USE.

Full Particulars may be obtained from the Sole Makers,
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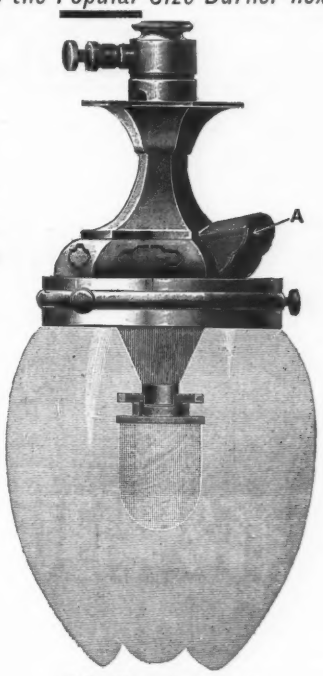
GLASGOW.
[See Illustrated Advertisement, June 8, p. 676.]

New Intermediate Size Burner.
THE "SIMPLICITAS"
Sure to be the Popular Size Burner next Season.

Treated with New Lacquer which will not discolour.



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1s. 9d. each.

½ Full Size.

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Coal Gas Enriched
FROM COAL GAS TAR.

LIGHT OILS VAPORIZED.

TAR IMPROVED FOR ROAD SPRAYING.

TAR CARBURETTING PLANT

PLANTS
ANY CAPACITY.

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MANCHESTER.

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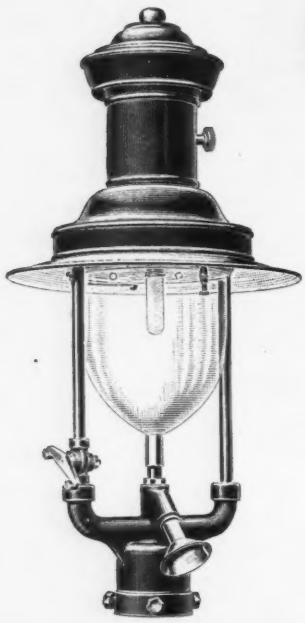

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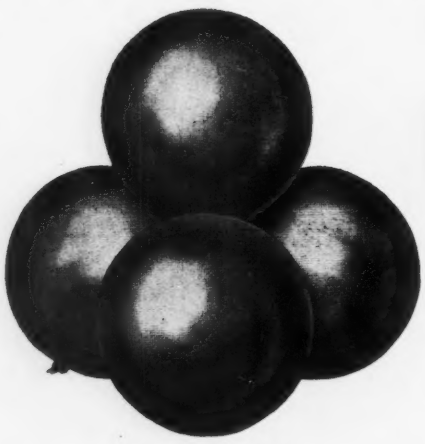

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BALL WASHER-SCRUBBER,

which is

THE MOST EFFICIENT ROTARY WASHER,

giving an immense amount of freshly wetted surface and scrubbing power.

120 in work varying in Capacity from **25,000** cubic feet per diem to **5,000,000.**

Also Makers of

CONDENSERS, IMPROVED LIVESEY WASHER, P. & A. EXTRACTORS, RETORT MOUNTINGS, and DRY LUTE PURIFIERS, with Clapham's Patent "Eclipse" Special Rubber Joint

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